Public consultation document for the design of the TERRE (Trans European Replacement Reserves Exchange)

RR Harmonized Balancing Area

30 of June 2017 (Start of the consultation)

Content

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1 Introduction

1.1 Overview of the project

To support the implementation of the Guideline on "Electricity Balancing" (GL EB), several pilot initiatives have been set up. TERRE (Trans European Replacement Reserve Exchange) is the pilot project validated by ENTSO-E for cross-border (XB) Replacement Reserve (RR) exchanges.

The TERRE solution should enhance the experience of the current BALIT bilateral solution used between NG-RTE, REE-RTE and REN-REE. The TERRE project uses the previous work of REN, REE and RTE in developing an enduring regional solution for the exchange of balancing energy between the TSOs.

The TERRE project involves several TSOs from UK to Italy. The TERRE project expects to include additional observers and participants before the Go-Live

Participants:

- NGET
- REE
- REN
- RTE
- Swissgrid
- Terna

Potential candidates:

- ADMIE
- Statnett SF
- Svenska Kraftnät
- Fingrid
- Energinet.dk
- Ceps
- Transelectrica
- MAVIR
- HOPS
- PSE

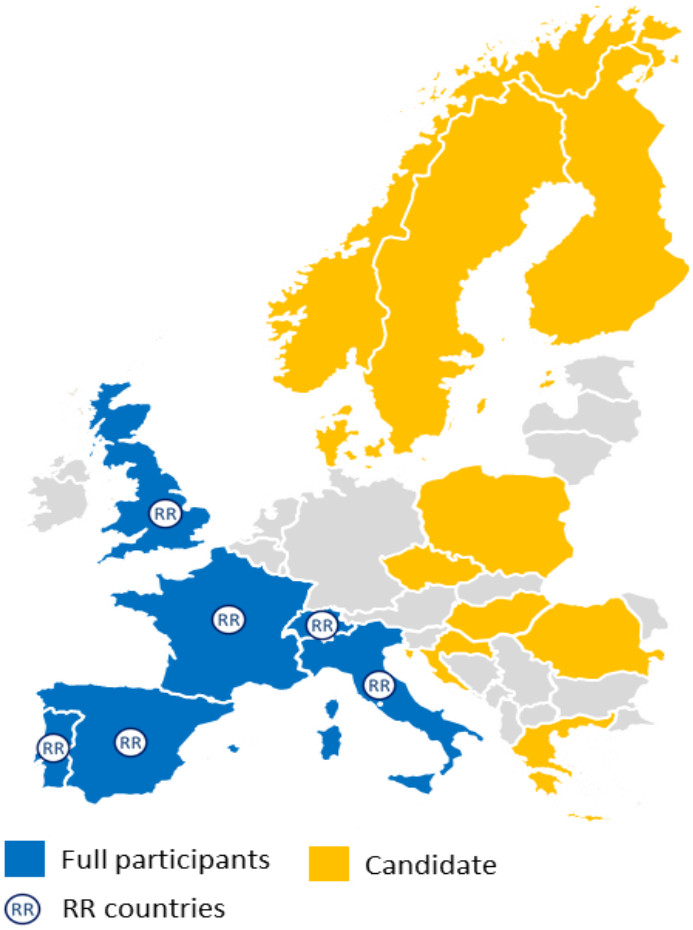

Figure 1-1: TERRE project Participants and Observers

The TERRE project progressed through its design phase under the legal scope of a Memorandum of Understanding (MoU) and Non-Disclosure Agreement (NDA). During the

public consultation phase[1], end 2016, the TERRE project was positively evaluated by the stakeholders and the NRAs. A common position paper[2] has been provided by the NRAs, addressing additional improvements and recommendations to the project.

At present, the TERRE project has launched the implementation phase under a Cooperation Agreement (CA) between the TSOs. This phase includes the development of the common RR platform, called "LIBRA", the follow-up of the local implementation by the participants, and the preparation for the parallel testing and the Go-live. As requested during the first consultation phase, the harmonization topic has been included in the project scope in order to mitigate the variations and ensure a level playing field between the participating parties.

1.2 Scope and goals of the project

As explained during the first consultation phase, the scope of the project is to implement a multi-TSO coordinated exchange of RR - XB balancing energy with the aim of being compliant with the GL EB. The model for the Exchange of the Balancing Service considered in this project will be the TSO-TSO model. In addition, this consultation paper will present the TSOs' position on the TSO-BRP and TSO-BSP interaction.

The main objective of the TERRE project is to establish and operate a platform (LIBRA) capable of gathering all the offers for RR from TSOs' local balancing markets and providing an optimized allocation of RR, covering the TSOs' imbalance needs.

1.3 Description of the implementation phase

The first consultation paper that was published in 2016, described the design of the TERRE solution. This has been built in order to be compliant with the requirements of the implementation of TSO-TSO balancing model according to:

- The Framework Guidelines on Electricity Balancing published by ACER on the 18th of September, 2012;
- ACER Qualified Recommendation on EB published on the 20th of July, 2015;
- On the 16th of March 2017, the ECBC recommended the adoption of the Guideline on Electricity Balancing. It is now under translation and scrutiny period after which it should be adopted provided that it is not blocked by the European Parliament or the EU Council. The expected entry into force of the GL EB is December 2017.

[1] ENTSO-e; 2016; https://consultations.entsoe.eu/markets/terre/user_uploads/20160307__terre_consultation.pdf

[2] ENTSO-e; 2016; https://www.entsoe.eu/Documents/Network%20codes%20documents/Implementation/Pilot_Projects/20160614_TERRE_Consultation_Project_Answers_Stakeholders_Version.pdf

The implementation phase is the new milestone in the TERRE project and will include the following working packages:

- **Implementation of the LIBRA platform**: the technical design description, the development, implementation and testing of the LIBRA platform. Additionally, the regional implementation will be monitored in this stage.
- **Establishment of the governance process**: it includes the governance of the TERRE project and the definition of rules and guidelines to operate and monitor the LIBRA platform after the go-live. The process to include new TSO members to the project will also be defined in the governance rules.
- **Harmonization of the RR market:** this will mainly address the national differences of RR products, TSO-BSP/BRP settlement procedures and the potential harmonization issues. Table 1 provides an overview of the harmonization topics handled by this consultation paper.

Topics	Section	Harmonized	Timing
Cap and floor prices	2.3.3	Yes[3]	Go Live LIBRA Platform
Product and Imbalance Need	3.1	Yes[4]	Go Live LIBRA Platform
TSO-BSP Settlement rules	3.2.2	Yes	Go Live LIBRA Platform
Market parties' incentives	3.2.2	Yes[5]	Go Live LIBRA Platform
Balancing in terms of Energy/Power	3.2.2	No	Future harmonization
Relationship BSP/BRP	3.2.2	No	Future harmonization
Control provision of balancing service	3.2.2	No	Future harmonization
Energy deviation settlement prices	3.2.2	No	Future harmonization
Imbalance adjustment	3.2.2	No	Future harmonization
RR TSO-BSP Balancing GCT	3.3.2	Yes	Go Live LIBRA Platform
Transparency	4	General	Go Live LIBRA Platform

Table 1: Overview Harmonization topics addressed by the Consultation Paper

[3] The TSOs aiming at harmonizing the caps and floors, but this is pending on the NRAs' approval.

[4] The incentivized product shape submitted by the BSP may differ for some TSOs

[5] The TSOs intend to provide same incentives through different models.

1.4 Objectives of the document

This consultation paper will serve as an extension of the first consultation document.

- **Chapter 2** will present the LIBRA platform and the TSO-TSO processes. Under this chapter, complementary explanation to the first consultation paper will be provided and harmonization proposals on the TSO-TSO level will be presented. Additionally, specific cases such as the Italian market design and the French-Swiss border exchange will be addressed in this chapter.
- **Chapter 3** will mainly focus on the TSO-BSP and TSO-BRP processes and market design. The current national settlement rules and RR product profiles will also be presented, followed by a harmonization proposal. The non-harmonized aspects will also be highlighted.
- **Chapter 4** will present the common rules related to the publication of national and XB balancing information.
- **Chapter 5** will describe the proposed governance structure for the TERRE project and the model for the operational and monitoring part of the LIBRA platform.
- **Chapter 6** will present the main objectives of the local implementation.
- **Chapter 7** will present the foreseen planning for the implementation phase, next steps and possible evolution.

This document aims to share the results of discussions the TERRE TSOs conducted in scope of the harmonization issues. The document provides the stakeholders the ability to express their comments on the different harmonization aspects which are proposed.

The comments will be consolidated via a transparent consultation tool based on the results presented in the following parts of this document:

- Consultation material is available on ENTSO-E consultation platform
- The **consultation process starts on 30th of June 2017** and lasts for **6** weeks: the consultation **platform will be closed for responses on 16th of August 2017.**
- In order to respond to the consultation, **stakeholders have to take part in the Online Survey** available on ENSTO-E consultation platform. The survey **has 30 open questions**, linked to the chapters of the present document. Each chapter also includes questions allowing stakeholders to freely comment on the proposed solution. The survey also includes a generic introduction question for stakeholders to freely comment on the whole document.

After due consideration and evaluation of all comments, project partners will formally seek support for the TERRE solution from the NRAs.
NB1: Formal NRA approval will be sought under the scope of the GL EB, with the submission of the Implementation Framework for RR, six months after its entry into force.
NB2: The stakeholders are invited to consider this consultation with high importance. On some topics, this phase is the final opportunity for stakeholders to share their opinions (e.g.: TERRE TSO-TSO model or TERRE TSO-BSP and TSO-BRP harmonized rules topics).

1.5 Questions for Stakeholders

Q 1.1 Do you have specific comments regarding Chapter 1 content? (Please indicate sub-chapter reference when possible)

2 TERRE TSO-TSO Model

2.1 Description of the LIBRA platform

This section intends to summarise the key aspects of the LIBRA platform. The initial objective of the LIBRA platform is to support the exchange of RR on a regional level. In a subsequent phase, the platform may support also the exchange of manual Frequency Restoration Reserves (mFRR).

The LIBRA platform will gather all the RR offers from the participating TSOs' local balancing markets and provide, on a regional level, an optimised allocation of RR in order to meet the TSOs' imbalance needs.

The general interactions between the LIBRA platform and the different market entities are illustrated in the Figure 2-1. The TSOs receive offers from the BSPs in their local market balance areas. The offers which are coherent with the TERRE product are forwarded to the LIBRA platform. TSOs also communicate their imbalance needs to the platform, as well as the available XB transmission capacities (ATC).

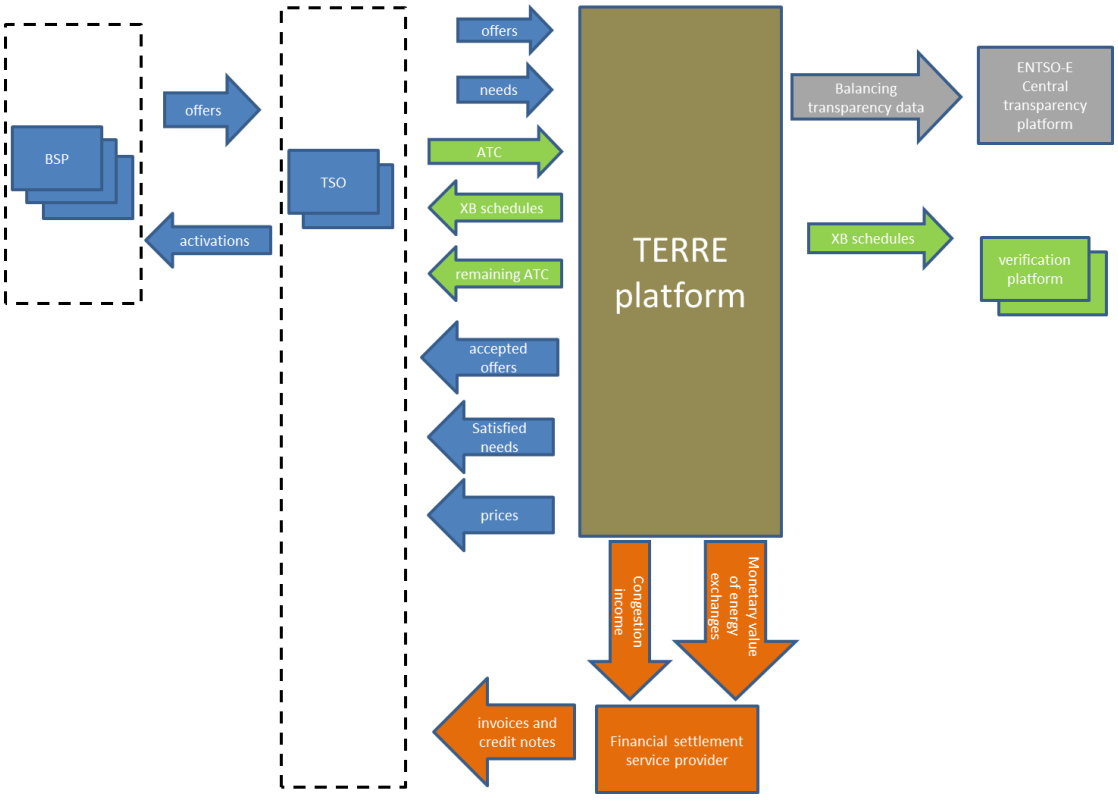

Figure 2-1: LIBRA Platform Flows

The LIBRA platform executes an algorithm that on a regional level optimises the clearing of the TSOs' imbalance needs against the BSPs' offers. An important output of this algorithm is the price at which needs were allocated to offers. The platform communicates back to the TSOs the accepted offers, the satisfied needs and the prices. Based upon this allocation of RR, the platform calculates the commercial flows between the market balance areas in the

region. The resulting XB schedules and remaining ATC are sent to the TSOs and possibly also to verification platforms operated by Capacity Coordinators.

Data that must be published according to the transparency regulation 543/2013 are sent to the central transparency platform operated by ENTSO-E. In addition to the automatic sending of data in each delivery period, TSOs can also request from the platform copies of all the input and output data (from all TSOs) as may be needed for TSO business processes or responsibilities.

Finally, the information required to settle expenditure and revenue between TSOs, i.e., the financial value of the energy flows across borders, is sent to the service provider responsible for Accounting between TSOs. This third party will in its turn issue invoices and credit notes to the TSO regions, collect payments and distribute reimbursements.

2.2 TSO-TSO model: complement to the first consultation phase

This section will provide additional explanations on the topics requested by the market participants in the first consultation paper and the NRAs and in the common position paper.

2.2.1 Counter-Activation

Counter-activations have been described in the first consultation, and a first study using historical data was presented in order to show the frequency of such phenomena in the TERRE region.

As indicated in the first consultation paper, TERRE TSOs support the allowance of counter-activations as they enhance the efficiency of the TERRE balancing market, since they result in the highest social welfare, non-distorted price signals and the highest chances for BSPs to get activated, whereas they do not have any impact on system security.

However, the TERRE NRAs suggest a distinction of acceptable or non-acceptable counter-activations. More specifically, they support that counter-activations that do not serve a balancing purpose shall be avoided if possible, as it is not in the prerogatives of the TSOs to solve market failures for a purpose different than balancing. Such a distinction is presented in Figure 2-2; the counter-activations in green are considered to be acceptable and advisable by the NRAs, since they serve a balancing purpose, but the counter-activations in red are considered to be non-acceptable.

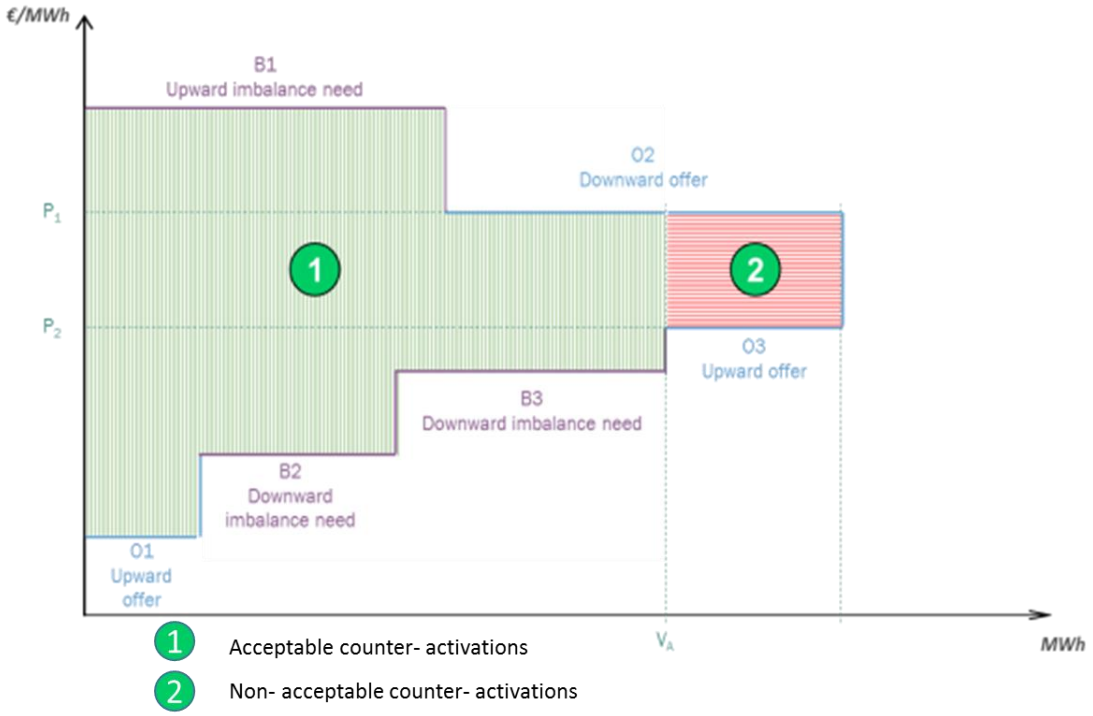

Figure 2-2: NRAs' proposal: distinction of counter-activations

Example

The following example will illustrate this proposal. We assume a region with three TSOs as depicted in Figure 2-3 and infinite ATC. The BSP offers are presented in Table 2 and the imbalance needs are presented in Table 3. The respective Merit Order List (MOL) is illustrated in Figure 2-4.

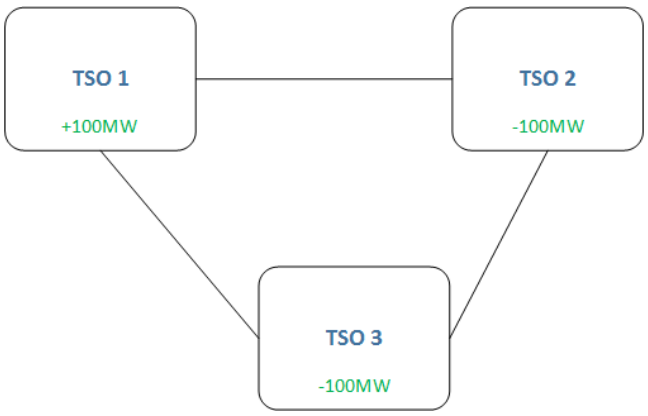

Figure 2-3: Example region

Connecting TSO	ID	Direction	Vol-ume(MWh)	Price (€/MWh)	Type
TSO 1	Offer 1	Upwards	50	5	Divisible
TSO 1	Offer 2	Upwards	50	30	Divisible
TSO 2	Offer 3	Downwards	200	50	Divisible
TSO3	Offer 4	Upwards	50	60	Divisible
TSO 3	Offer 5	Downwards	50	40	Divisible

Table 2: Example BSP offers

TSO	Direction	Volume (MWh)	Price (€/MWh)
TSO 1	Upwards	100	100
TSO 2	Downwards	100	10
TSO 3	Downwards	100	20

Table 3: Example imbalance needs

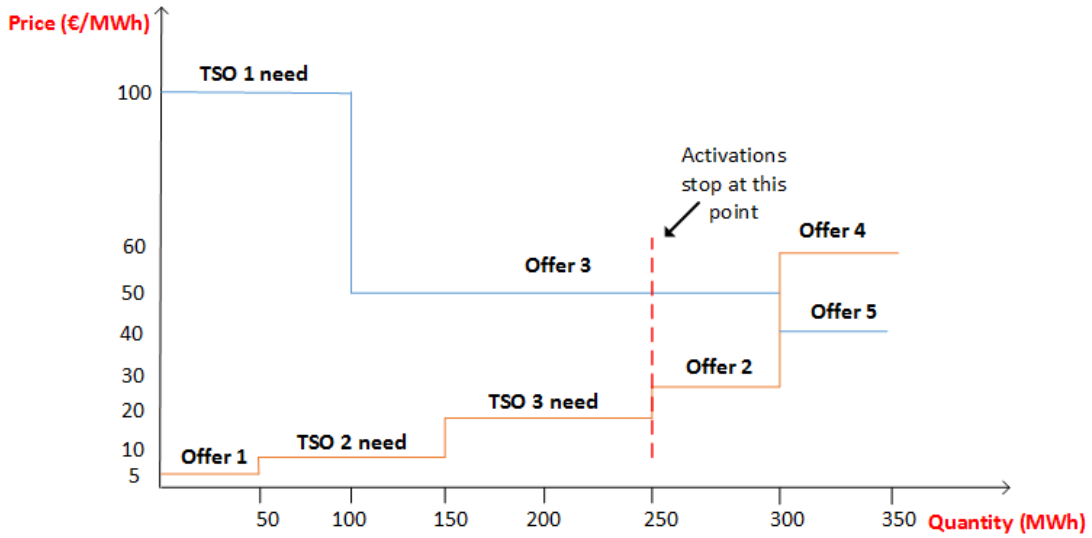

Figure 2-4: Example Merit Order List

According to this suggestion, offer 1 shall be activated, whereas only 150MW of offer 3 shall be activated, even if the activation of the whole offer 3 and the activation of offer 2 would increase the social welfare. We observe that the marginal price is lower compared to the case that counter-activations would be allowed and the social welfare is decreased. In addition, this would not be possible to implement if some offers, offer 3 in this example,

were blocked offers. In this case, offers 3 and 2 would be allowed to activate and would be considered counter-activations serving a balancing purpose.

This solution could prove to be difficult to implement, especially if rules for unforeseeably rejected bids (see section 2.2.2) and rules for counter-activations are mixed. The application of both rules could lead to infeasibilities; therefore a priority amongst this set of constraints has to be defined. Finally, note that we could have counter-activations due to ATC constraints and not due to increase of social welfare. It may be challenging for the algorithm to distinguish such cases, i.e. allow counter-activations due to ATC and due to block offers, but not in cases presented in Figure 2-4.

TERRE TSOs have been engaged to make an analysis on the frequency and volumes of counter-activations, as well as on the impact of a potential restriction on the computation time, during the parallel run phase and at a first stage of the project. The final approval of the counter-activations by the NRAs will be subject to this analysis.

2.2.1.1 Impact on the marginal price

If the counter-activations are prevented, the marginal price will be affected in an unpredicted way; in some cases, the prevention of counter-activation may increase the marginal price, whereas in other cases it is expected to decrease the marginal price. In addition, it will result in the exclusion of upward (downward) offers with a lower (higher) price than the resulting marginal price, as depicted in Figure 2-5 and Figure 2-6. These offers are hence a part of the unforeseeably rejected offers described in section 2.2.2, but stem from the exclusion of counter-activations.

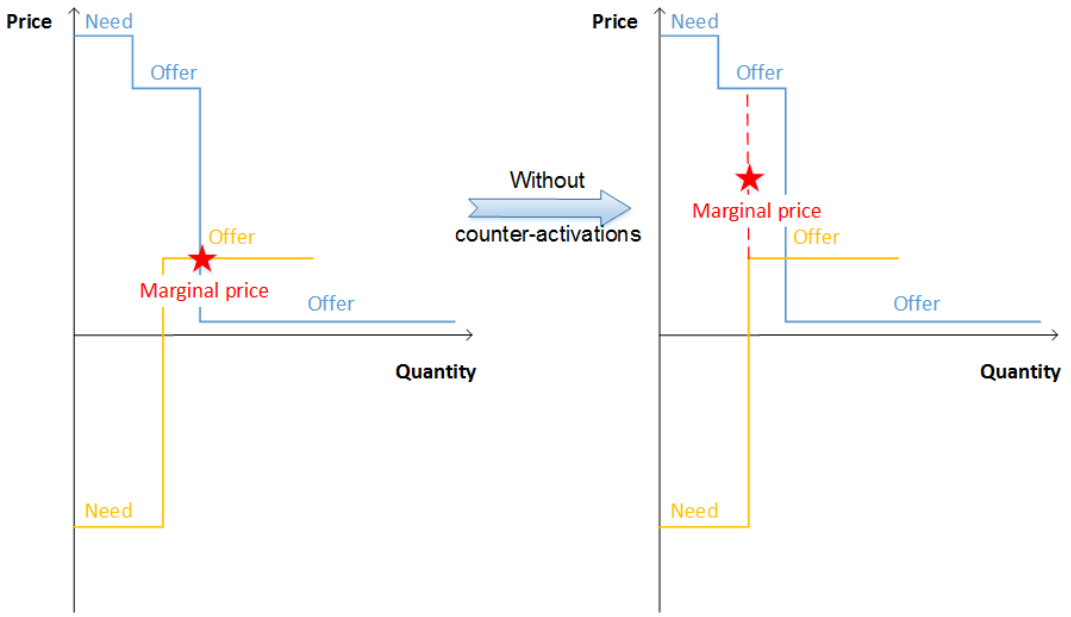

Figure 2-5: Exclusion of counter-activation increases marginal price

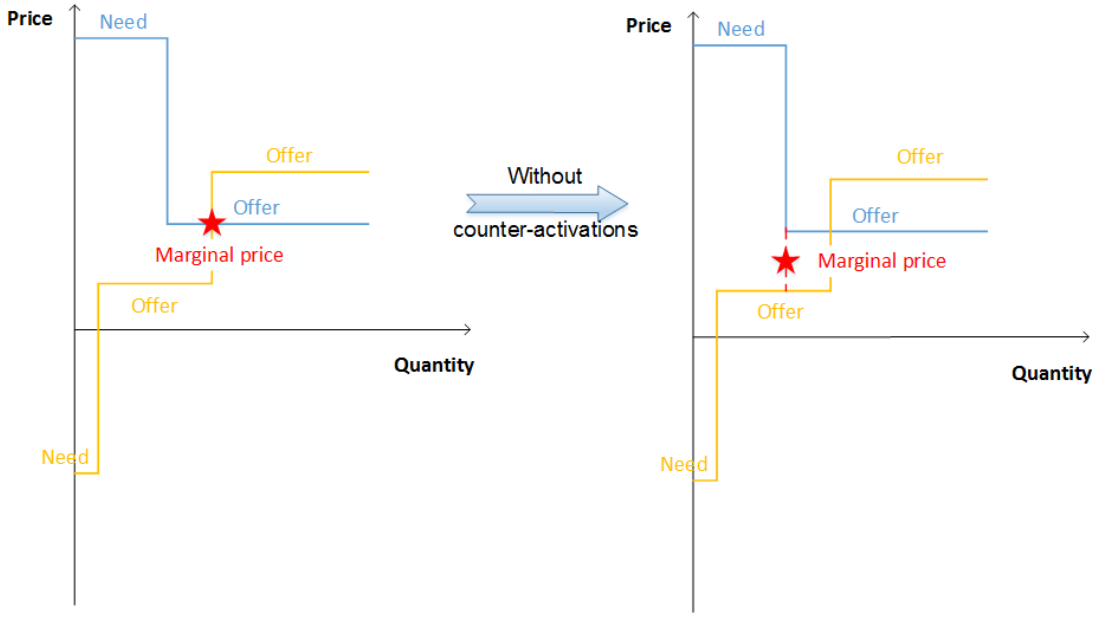

Figure 2-6: Exclusion of counter-activation decreases marginal price

2.2.1.2 Impact on the ID market

In the previous consultation paper, concerns were raised regarding the impact of counter-activations on the ID market. More specifically, it was expressed that the combination of an incentive gap through marginal pricing and a higher probability of activation on the LIBRA platform through counter-activations could impact the ID market liquidity.

The GL EB includes several references aiming at guaranteeing that the balancing markets do not endanger the efficiency of the previous markets such as the ID. Examples of such rules are the GCT, rules for updating the positions from the BRPs, rules for the submission of balancing bids to the European platforms, as well as pricing and settlement principles. These references will be followed by TERRE project in order to contribute to the efficient functioning of the energy markets (DA/ID). For example, TERRE TSOs aim at designing an efficient balancing market with a GCT not before the gate closure of the XBID Market, as foreseen by the GL EB. Moreover, the bids submitted to the LIBRA platform shall be prequalified to fit the profile of the RR balancing product which is described in section 3.1.2.1; this clearly differentiates them from the authorized bids of the ID market. Therefore, due to aforementioned features, we believe that the allowance of counter-activations in TERRE will not affect the liquidity of the ID market. We would like to stress that TERRE TSOs would not be in favour of adding inefficiencies in the balancing market (restriction of counter-activations) for solving potential inefficiencies of previous markets.

2.2.2 Unforeseeably rejected bids

The optimization algorithm seeks to optimize the social welfare of the TERRE region. In addition, not only divisible offers (with zero minimum quantities), but also more complex balancing energy offer formats are expected to be submitted. Therefore, there may be cases where a rejected upward (downward) balancing energy offer has a lower (higher) price than

the marginal price. These offers are named unforeseeably rejected bids (URBs). The URBs might also occur in case of Interconnection Controllability which is described in section 2.2.5.

Figure 2-7 presents an example with an unforeseeably divisible rejected offer. We assume that there are three upward offers: two divisible and one block offers, and a single positive inelastic need. If all offers were divisible with zero minimum quantities, the cheapest divisible offer and a part of the block offer would be accepted to satisfy the positive inelastic need. However, we cannot accept only a part of the block offer; either the whole block offer is accepted or the whole block offer is rejected.

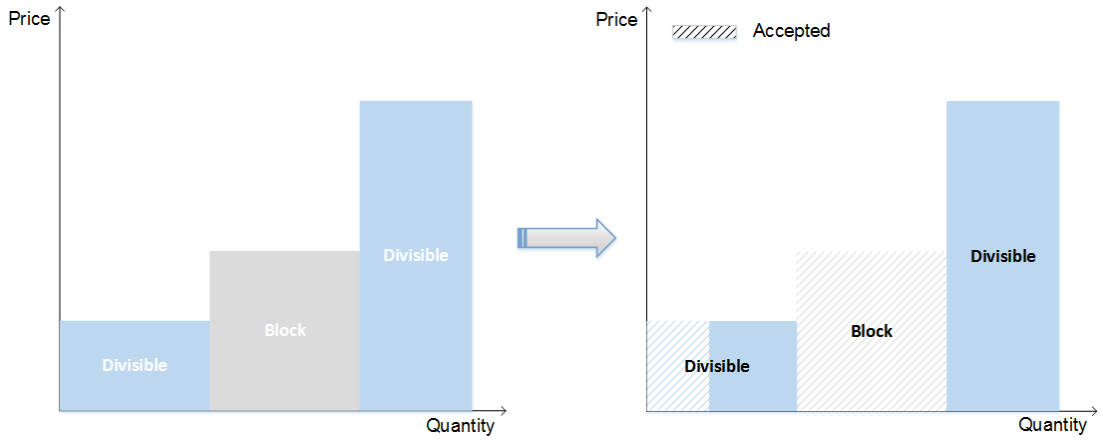

Figure 2-7: Example of an unforeseeably rejected divisible offer

TERRE TSOs are considering two options regarding URBs:

Option 1

A first option would be to allow unforeseeably rejected divisible bids. In the example of Figure 2-7, the block offer would be accepted and a part of the previous divisible offer would be rejected in order for the social welfare to be optimized. If we want to prevent the existence of unforeseeably accepted bids (UAB = bids that are accepted but have a higher price than the marginal price), the price shall be equal to the price of the block offer; hence, the divisible offer has a lower price than the resulting TERRE price, but a part of it is rejected. This offer is called unforeseeably rejected offer. All type of offers can be unforeseeably rejected, e.g. both divisible and block offers.

The main advantages of this option are hence that (a) the social welfare is optimized, (b) all offers, either divisible or complex offers are treated equally and (c) no additional constraints are necessary. The main disadvantages are that (a) additional transparency may be requested so as the market participants to understand why some offers were rejected and that (b) BSPs are not incentivized to submit divisible offers.

Option 2

A second option would be to allow only unforeseeably rejected block offers, whereas no divisible offer could be unforeseeably rejected. In this case the solution would be to reject the block offer, and accept the whole cheapest divisible offer and a part of the more expensive divisible offer. The social welfare would be reduced, and the block offer would be rejected even if its acceptance would increase the social welfare.

This option guarantees that divisible bids below the marginal price will always be awarded and provides greater incentives for BSP not to place block bids if they are able to avoid it, as only indivisible bids can be unforeseen rejected. In addition, this option ensures consistency with treatment of block bids in previous timeframes, as it is currently implemented in DA market coupling.

Note that in order to impose such a solution, additional constraints would be necessary. Depending on the number of offers as well as on the frequency of such phenomena, it may not be feasible to find a solution, considering the required time constraints. More specifically, the experience of DA market coupling indicates that it may be challenging to find a solution within such a short time. However, if this is the preferred solution, TERRE TSOs may consider following this approach, if this is proven to be feasible during the implementation phase. Note that if this solution is chosen, in practice TERRE TSOs would minimize and completely forbid the URB, as this may have a huge impact on the social welfare.

The main advantages of this option are that: (a) it is consistent with previous markets and (b) incentivizes BSPs to submit divisible bids. The main disadvantages are that (a) social welfare of each run is not optimized, (b) additional constraints or iterations are necessary and (c) additional transparency may be requested so as the market participants to understand why some offers were rejected, similarly to the first option.

An example presenting the results of the two options is the following one:

Basic example of bid selection with indivisible bids:
TSO demand: 10 MWh
Bid 1: 7 MWh @ 9 €/MWh indivisible
Bid 2: 1 MWh @ 10 €/MWh divisible
Bid 3: 3 MWh @ 11 €/MWh indivisible
Bid 4: 9 MWh @ 12 €/MWh divisible

First option:
Bid 1: 7 MWh @ 9 €/MWh indivisible ➔ fully accepted
*Bid 2: 1 MWh @ 10 €/MWh divisible ➔ (*unforeseen*) rejected*
Bid 3: 3 MWh @ 11 €/MWh indivisible ➔ fully accepted

Bid 4: 9 MWh @ 12 €/MWh divisible ➔ rejected
Marginal price: 11 €/MWh
Total balancing cost: 110 €

Second option:
Bid 1: 7 MWh @ 9 €/MWh indivisible ➔ fully accepted
Bid 2: 1 MWh @ 10 €/MWh divisible ➔ accepted
*Bid 3: 3 MWh @ 11 €/MWh indivisible ➔ (*unforeseen*) rejected*
Bid 4: 9 MWh @ 12 €/MWh divisible ➔ partially accepted (2 MWh)
Marginal price: 12 €/MWh
Total balancing cost: 120 €

Figure 2-8: Examples of unforeseen rejected offers handling

Note that the need flexibility described in section 2.5.1. is used to reduce phenomena of URBs; in the previous example, it is possible that both offers, both the divisible and the block offer would be accepted if the positive need was flexible. However, we cannot guarantee that this will happen in all cases and if further constraints or iterations are not introduced, we expect to have unforeseeably rejected offers.

Note that unforeseeably accepted bids (UAB), i.e. accepted upward (downward) offers with higher (lower) price than the resulting price of the bidding zone will not be allowed. If a bid is UAB for a specific time period but not for the whole delivery period, i.e. in case of a linking offer, then this bid is not considered to be a UAB.

2.2.3 DC and AC Energy losses

Grid losses are a physical reality of both HVDC and AC grid. This implies that each allocation on a border with losses ends up with an allocation volume in the exporting area which differs from the allocated volume in the importing area. LIBRA will consider the losses on the HVDC interconnectors, whereas losses in AC links will not be considered, as currently done by the DA market coupling. The explanation below is compliant with DA market coupling proposal.

It was concluded that the optimal way to consider losses incurred by an exchange across HVDC interconnectors is to include them directly as an implicit constraint on XB exchanges in the LIBRA algorithm. More specifically, losses will be included in the overall supply and demand equilibrium constraints of the bidding zones with HVDC interconnectors, as illustrated in Figure 2-9. In addition, losses are considered to be linear to the flow exchange, i.e., they are a fixed percentage of the scheduled exchange as specified by the operators and they are applied based on the overall interconnector loss value, unlike the value to mid interconnector, as detailed below.

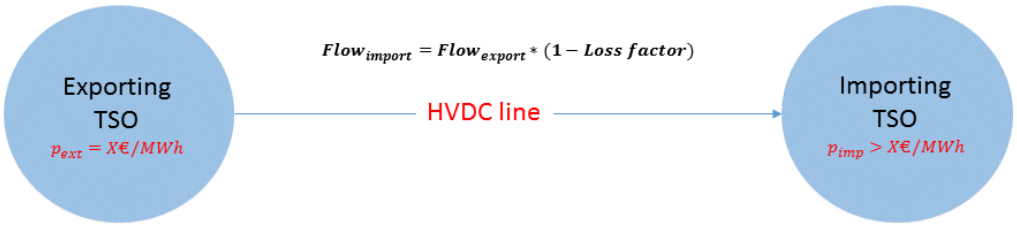

Figure 2-9: Losses in HVDC interconnectors

The high level properties on scheduled exchange, prices and congestion rent are the following:

- $Flow_{import} = Flow_{export} * (1 - loss\ factor)$
- $P_{import} * (1 - loss\ factor) - P_{export} = 0$ when no congestion and there is no congestion rent, even if there is a price differential.
- $P_{import} * (1 - loss\ factor) - P_{export} > 0$ when the line is congested and thus there is a congestion rent, calculated as: $P_{import} * Flow_{import} - P_{export} * Flow_{export}$

Note that this does not hold for adverse flows, i.e. flows from a more expensive to a cheaper area that may occur due to e.g., interconnectors' controllability constraints.

For IFA, as the algorithm does not recognize the mid-channel reference, we consider the IFA combined Loss Factor equal to 1 - (1-LF) / (1+LF), with LF being the Loss Factor at mid-channel.

The social welfare is also decreased by those losses that can be calculated as:

$$\sum_{all\ interconnectors} (Flow_{export} * p_{export} - Flow_{import} * p_{import})$$

Those financial costs of HVDC losses are therefore implicitly borne by all LIBRA participants (not always proportionally though), as the consideration of losses directly affect the prices in the respective borders.

2.2.4 Physical feasibility description

The notion of physical feasibility has been introduced in the LIBRA algorithm in order to calculate the maximum volume of energy upward and downward that the asset can effectively accommodate without generating imbalance. Flow transfers on HVDC links can be limited by either:

- technical characteristics of the assets:
  - ramping constraint -> but these are usually not limiting as higher than SO imposed ramping constraints
  - maximum and minimum power flow (no possibility of over-shooting as it could be the case on AC networks)
- SO imposed restrictions:
  - Ramping constraint (currently 100MW/min on IFA asset)

- Maximum difference between commercial position and physical set point of the link

If physical feasibility was not introduced, this would lead to situations where the interconnector owner would not be able to flow the expected amount of power, and would therefore be accountable for imbalance in both power markets for this undelivered energy.
The inputs required for calculating the physical feasibility are both the latest Interconnector Reference Program (ICRP) and the abovementioned interconnector constraints. The output of the calculation is the biggest interval of energy (upward and downward) admissible on the asset without generating forecasted imbalance.
The Physical Feasibility will be sent to LIBRA Platform by TSOs as the equivalent ATC value for DC interconnections.

2.2.5 Interconnection Controllability

The calculation of the capacity offered to the market is fundamentally different between AC and DC borders. On DC borders (within the GB market and elsewhere) the nameplate rating is generally offered into the market (i.e. no capacity is held in reserve to cater for faults, operational issues etc.). However this is not the case for AC borders where capacity can be reduced to cater for operational requirements (e.g. n-1).

For DC borders, this can lead to times where the market benefit that the extra capacity brings is outweighed by the operational costs of providing the capacity. Therefore, to avoid such situations and maximize social welfare, TSOs need to manage HVDC links in operational timescales as certainty of power system conditions increases. TERRE allows these TSOs to manage HVDC links by submitting to LIBRA a desired flow range across the HVDC.

The TERRE TSOs decided to extend this functionality which was first considered for HVDC links also to AC borders and implement Interconnection Controllability within LIBRA. As opposed to current explicit counter-trading[6] where the cross zonal (CZ) exchange is initiated by system operators between two bidding zones to relieve physical congestion, this change in CZ exchange is implicitly converted as a constraint in the algorithm. Each TSO defines hence new bounds for the bilateral commercial exchange for the border to be controlled. If the new bounds are respected by reducing the available capacity across the respective border, the available capacity reduction is done before TERRE, in the same way as today. However, if a reversal of the exchange is required to respect the new bounds, the TSO can define a minimal desired exchange in a specific direction (i.e. a negative capacity). The optimization algorithm constrains the flow across the specific border, considering the desired

[6] As allowed in the commission regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management.

exchange submitted by the TSO. Note that this is a hard constraint; therefore it will be respected irrespectively of the cost.

The offers that will be accepted by the optimization algorithm, and hence, will be activated, will respect the constraint of the desired exchange. However, the settlement between TSOs will be done based on the marginal prices resulting from the algorithm without considering the desired exchange constraints. The accepted offers with higher price than the marginal price will be paid to the BSPs based on pay-as-bid.

We consider the following example to explain the aforementioned activations and settlement option.

Example:

We consider the system depicted in Figure 2-10 and the offers presented in Table 4. For the sake of simplicity, all offers and needs have a validity period equal to the market time unit, i.e. 60 minutes, and all needs are considered to be inelastic and inflexible. The ATC between TSOs 2 and 3 is large enough so as not to influence the results, whereas the submitted ATC between TSO 1 and 2 is 50MW for the one direction (1 -> 2) and 0MW for the opposite direction (2 -> 1). As illustrated in Figure 2-10, TSO 1 submits a desired minimum flow of 30MW.

Figure 2-10: Example Interconnection Controllability

TSO	Offer direction	Offer quantity (MW)	Offer price (€/MWh)
1	Upward	40	50
1	Upward	50	60
2	Upward	60	60
2	Downward	50	-35
3	Upward	80	30
3	Upward	90	40
3	Downward	50	-5

Table 4: Example Interconnection Controllability: submitted offers

The optimization algorithm considers the desired flow of 30-50MW and gives the results presented in Figure 2-11 and Table 5.

Figure 2-11: Example Interconnection Controllability: results

TSO	Offer direction	Offer quantity (MW)	Offer price (€/MWh)	Activated quantity (MW)
1	Upward	40	50	40
1	Upward	50	60	10
2	Upward	60	60	0
2	Downward	50	-35	0
3	Upward	80	30	70
3	Upward	90	40	0
3	Downward	50	-5	0

Table 5: Example Interconnection Controllability: activated offers

The optimization algorithm will be executed once more (sequentially or in parallel with the first run), without considering the minimum desired flow constraint. The results of the second unconstrained run are presented in Figure 2-12 and Table 6.

Figure 2-12: Example Interconnection Controllability: results of unconstrained run

TSO	Offer direction	Offer quantity (MW)	Offer price (€/MWh)	Activated quantity (MW)
1	Upward	40	50	20
1	Upward	50	60	0
2	Upward	60	60	0
2	Downward	50	-35	0
3	Upward	80	30	80
3	Upward	90	40	20
3	Downward	50	-5	0

Table 6: Example Interconnection Controllability: accepted offers in the unconstrained run

The price at the bidding zone of the TSO 1 will be 50€/MWh, and the price at the bidding zones of the TSOs 2 and 3 will be 40€/MWh. Note that the accepted offers of the constrained

run, presented in Table 5, are activated but the marginal price is the result of the unconstrained run.

As aforementioned, some uplifts will be given to BSPs that were activated but had higher submitted price for upward offers (or lower submitted price for downward offers). More specifically, these BSPs will be paid with pay-as-bid. In the above example, this holds only for one offer: from the area of TSO 1, an offer with submitted price 60€/MWh was activated, but the marginal price is 50€/MWh. This offer will thus be paid with 60€/MWh instead of 50€/MWh. Note that this offer belongs to the TSO 1 who requested the Interconnector Controllability, and will hence not affect the TSO-TSO settlement. The uplift given to this BSP, i.e. 60€/MWh·10MW−50€/MWh·10MW=100€, will come from the TSO 1 who requested the controllability.

2.2.6 Unavailable bids

Unavailable bids refer to bids submitted by the BSP that have been flagged by the local TSO and are therefore blocked from being activated by the platform. The reasons for marking a bid unavailable are:

- for local congestion issues: the activation of the bid will somehow endanger the grid situation locally if activated.
- for local lack of margin: the activation of this bid by other TSO will alter the margin reserve of the TSO and would result in the activation of exceptional or emergency resources in order to replace them. An example might be bids with a limited amount of energy per day, which might have to be reserved by the TSO to ensure enough margin for high demand period during the day.
- for fulfilling the local requirements for Frequency Restoration Reserves with manual activation (mFRR) or Frequency Restoration Reserves with automatic activation (aFRR)

2.3 TSO-TSO settlement

As a consequence of the exchange of balancing energy in TERRE, there will need to be a settlement mechanism between the TSOs. This topic was presented in the last public consultation on TERRE.

The key features of the TSO-TSO settlement are:

- Settlement of the energy exchanged based on pay- as-cleared[7], following the guidance provided by the GL EB

The energy commercially scheduled and settled between the TSOs will be the energy block over the corresponding period (not including the possible energy associated to the ramps

[7] For explanation on marginal price (pay-as-cleared), please refer to the annex

outside the period will not be considered, in line with the definition of standard product for RR by ENTSO-E (see Figure 2-13).

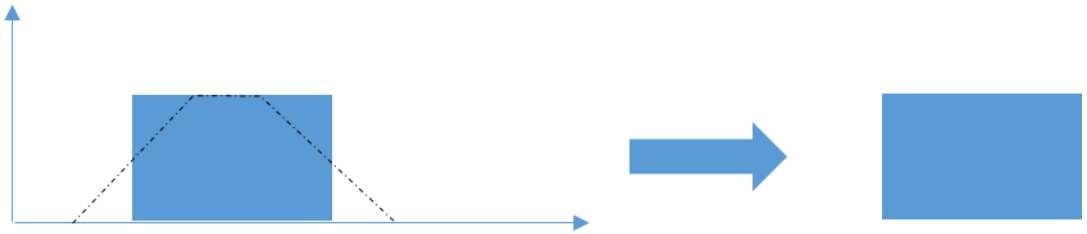

Figure 2-13. Energy volume scheduled and settled at XB level in TERRE

2.3.1 Price indeterminacy

An indeterminacy in price could occur when the intersection between the buying and the selling curve is a range of prices (and not a single point). See the example below:

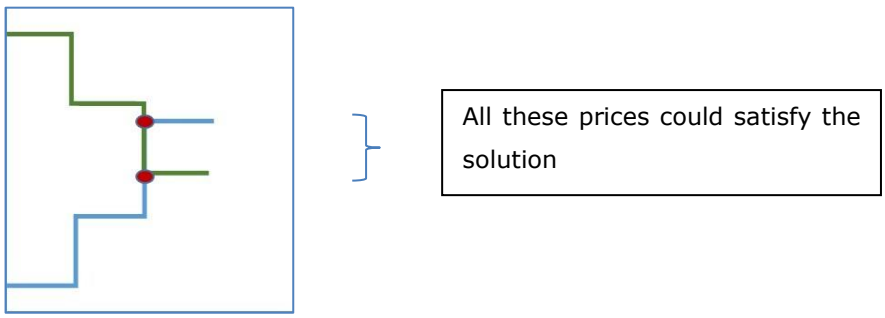

Figure 2-14: Indeterminacies in price: Possible solutions

To solve the indeterminacy, the proposed approach was to calculate the middle point of the shortest interval possible taking into account both the activated and not activated bids/needs. This is represented in the Figure 2-15 below.

This approach is the same as the one applied in the Day Ahead Market Coupling of Regions (DA MRC project): Middle price taking into account activated and not-activated bids/needs (in order to avoid URB).

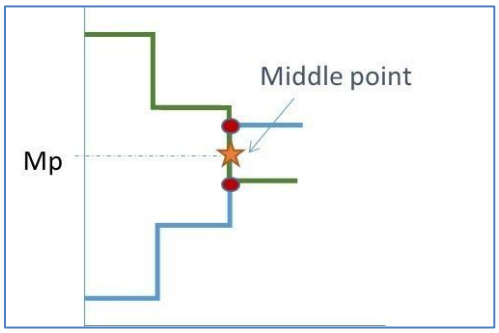

Figure 2-15: Indeterminacies in price: Middle price

2.3.2 Congestion rent

There could be situations where borders within TERRE become congested. In such a case, there could be different marginal prices on each side of the border. Each of these prices will be established based on the activated balancing offers and/or the satisfied imbalance need in the non-congested area.

Due to this price difference between the price that an area is "willing to pay" and the price that the other area is "willing to receive" at either side of the interconnector, a surplus will occur. This surplus, calculated as the multiplication of the exchanged balancing energy times the price difference, is called a "congestion rent" in other timeframes (such as the MRC project). In this case, the "TERRE congestion rent" would be:

TERRE congestion rent = TERRE schedule x (ΔP)

The TERRE schedule is the XB schedule between the two congested areas and ΔP the difference of marginal prices at both sides.

The distribution of congestion rents is a regulatory issue that shall be established with the input from the NRAs.

These congestion rents do not only happen in TERRE but also in other timeframes (e.g. Multi Regional Coupling in DA). Therefore the use of this congestion rent will be consistent with how it is used in other timeframes, and in line with the Regulation R 714-2009 article 16-6.

2.3.3 Cap and floor prices harmonization

Article 9 (Price restrictions) of the proposed revised electricity Regulation ("Clean Energy for all", or winter Package) advocates the non-existence of maximum and minimum prices in wholesale markets and also including balancing prices (as exceptions, value of lost load could be the maximum price and -2000 € or less for the minimum price).

In addition, the GL EB supports this provision and adds that: *"Article 30 (2). 2. In case TSOs identify that technical price limits are needed for efficient functioning of the market, they may jointly develop as part of the proposal pursuant to paragraph 1 a proposal for harmonised maximum and minimum balancing energy prices, including bidding and clearing prices, to be applied in all scheduling areas. In such a case, harmonised maximum and minimum balancing energy prices shall take into account the maximum and minimum clearing price for day-ahead and Intraday timeframes pursuant to Regulation 1222/2015."*

Currently, in some TERRE systems, caps and floors are applied to balancing energy, while in other systems balancing energy prices are not capped. Futhermore, there are some systems that currently do not apply negative prices to balancing energy (i.e. floor is 0€/MWh)

As expressed in the previous consultation, the proposal from TERRE TSOs is not to apply caps and floors to the balancing energy offers submitted to LIBRA platform. However, as this topic is ultimately under the NRAs scope, the TSOs have designed a backup solution which allows the functioning of TERRE with some systems applying floor prices (zero prices) and some systems not applying any floor. This backup solution was explained in the previous

TERRE consultation (Annex 3) and requires specific conditions for guaranteeing that there is no financial loss in the system that keeps the floor to 0 €/MWh.

2.4 TSO-TSO XB commercial scheduling step

In order to improve the exchange of energy between borders, we need to define a common XB scheduling step to be used in TERRE.

3 different possible XB scheduling steps (1 hour, 30 minutes and 15 minutes), were analysed. Currently all borders in the TERRE region have a XB scheduling step of 60min, with the exception of the France-Switzerland border which is 30mins.

Although in the beginning a XB scheduling step of 1 hour will be implemented, to take advantage of the possibilities that this project offers, TSOs are investigating the reduction of the XB scheduling step for balancing to 30 or 15 minutes, which will allow the exchange of further energy between TSOs.

Therefore the common solution will be robust enough to allow the reduction of the scheduling step during the implementation phase or a subsequent stage of the project and to deal with the different values in place between the borders of the countries that participate in the TERRE project.

The TERRE TSOs agree to reduce the XB scheduling steps less than 60min for the borders included in TERRE region. The deadline will be the GL EB required date of the implementation of the mFRR process. Starting from this deadline, the XB scheduling step will be 15min.

Starting from this date, some TSOs are likely to increase the number of daily TERRE processes (daily clearing).

The number of daily clearing will depend on the maturity of the European balancing market at that time.

2.5 Definition of imbalance needs

In a CMO, the TSO submits an imbalance need. This need has several characteristics, and some of them were already introduced in the first consultation paper.

Imbalance Need Characteristics	
Anticipation Time	Only needs anticipated 45 min or more before real time can be satisfied by TERRE
Minimum size	1 MW
Minimum delivery period	15 min
Max delivery period	60 min
Location	Bidding zones (ex: several needs for Italy)
Maximum Size	The maximum size of the imbalance need should be less or equal to the sum of the shared offers made in the same direction. Under certain conditions, a TSO can notify the system which will apply an exemption to this rule
Divisible Volume	Under the responsibility of TSO to a resolution of 1MW
Price	For inelastic needs TSOs will not price their needs. For elastic needs a price will be submitted, which will set a min/max price each TSO is willing to receive/pay to satisfy its needs. See Figure 2-16. Its resolution is 0.01€/MWh.
Time Resolution	15 min (linked to maximum XB scheduling step)
Firmness	Yes
Direction	Positive (system short) or Negative (system long)

Table 7: Imbalance needs characteristics

In the beginning, due to XB scheduling step constraint, the imbalance need will be constant over the hour.

For each TSO and quarter hour, the needs must have the same direction, and there cannot be more than one inelastic need.

2.5.1 Imbalance Need flexibility and elasticity

The flexibility is an imbalance need parameter that reflects the ability of a TSO to receive more (for upwards) or less (for downwards) energy than what was requested with the submitted imbalance need. It is similar to a tolerance volume on the imbalance need. The need flexibility will be used by the algorithm only if it results in a higher social welfare. It is particularly useful when a large amount of block offers are submitted, as flexibility reduces the number of URBs. Note that if all submitted offers are divisible, then the need flexibility will not be used.

We illustrate this functionality by the following example.

Example: use of flexibility for an elastic need

In this example, we consider only one TSO having a single elastic need of 300MW at 70€/MWh. The need flexibility is 50MW. We also assume that there are two offers: an upward offer of 320MW at 50€/MWh and a second divisible upward offer of 400MW at 60€/MWh. In

the first case (on the left side), the upward offer (UO) is divisible, whereas in the second case (on the right side) it is a block offer.

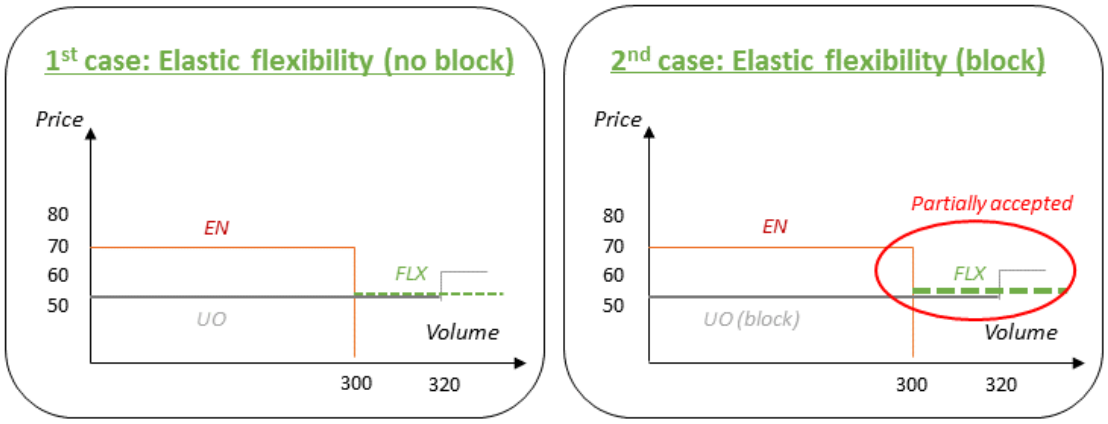

Figure 2-16: Example of need flexibility and elasticity

In the first case, the existence of flexibility on the elastic imbalance need is useless, as the algorithm will maximise the welfare without using the flexibility. Thus, the flexibility is not used, and the TSO's need is fully satisfied. The social welfare is equal to 6000 and the marginal price is equal to 50€/MWh.

In the second case, the flexibility of the elastic imbalance need allows the use of the UO block, and increases the social welfare compared to the situation where the need was inflexible. In this case, the block offer is fully accepted and the flexibility is partially used (20MW). Hence, the TSO has a satisfied need of 320MW. The social welfare is equal to 6000 and the marginal price is equal to 50€/MWh. Note that if the need was not flexible, 300MW from the second divisible offer would be activated. In this case, the social welfare would be equal to 3000 and the marginal price equal to 60€/MWh. Therefore, the upward block offer would be a URB.

2.6 TERRE process (TSO-TSO)

TERRE is a gate-managed system. Each phase of the process runs between the opening and the closure of the corresponding gate. All TERRE processes run until H-30min, where H corresponds to the beginning of the delivery period. After the TERRE processes are concluded, from H-30min to H, each TSO will activate its national units. The way that each TSO activates their local units is out of scope of this document.

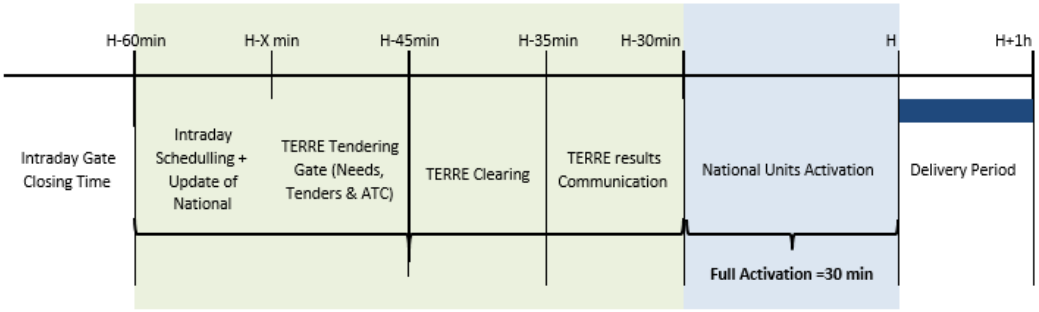

Figure 2-17: TERRE Process Timeline

As presented in the Figure 2-17:

- Parameter H-X min = RR BEGCT (applicable to BSP, please refer to section 3.3.2).
- Parameter H-45min = TSO-TSO Energy Bid Submission GCT (please refer to section 2.6.3).

2.6.1 Overall description

2.6.1.1 Pre-Tendering phase

The pre-tendering phase is the period between H-60m and H-X min, in which all TSOs receive the ID scheduling information and all BSPs can submit or update their balancing energy offers and send them to their connecting TSO. After H-X min, no balancing energy offers from the BSP will be accepted.

2.6.1.2 Tendering phase

In the tendering phase, all TSO will:

1. Calculate all their imbalance needs;
2. Calculate/update the available ATC;
3. The TSOs shall submit to the LIBRA platform all valid balancing energy offers (taking into account the conversion of bids in the CDS) from its connecting BSPs.

Additionally to these actions, some TSOs will perform operational security assessment in order to determine unavailable bids;

All this information will be sent by the TSO to the LIBRA platform before the end of the tendering phase, i.e., TSO-TSO GCT.

Before sending the ATC, each TSO shall confirm with the neighbouring TSOs the value of ATC that will be sent to LIBRA platform. How the ATC (communicated to LIBRA platform by each TSO and used in TERRE process) is confirmed among neighbouring TSOs is out of scope of this document.

2.6.1.3 Clearing phase

The algorithm computation phase is the period in which all balancing energy offers and imbalance needs are processed by TERRE, taking into account the submitted balancing energy offers and Imbalance Needs, the ATC, requirements and other constraints.

It is important to stress that in the event that more than one TSO submits ATC values for a given border, direction and period, LIBRA platform will apply the lowest value

The gate opening time of the algorithm computation phase coincides with the GCT of the tendering phase. The end of the algorithm computation phase will happen before the beginning of the results communication phase [H-35 min].

A period of 10 minutes is reserved for this process. This period includes the centralized platform fall-back procedures (as described in section 2.6.2)

If at the end of the time reserved for this process no results were produced by the algorithm, the fall-back procedure will be activated.

2.6.1.4 Results communication and verification

The results communication phase is between H-35min and H-30min. This period is reserved for:

1. The communication of all session results from the LIBRA algorithm to all TSOs, namely RR activation results (price and volumes), ATC used in the clearing process, residual ATC and final CMOL;
2. The communication of the scheduled exchange to the TSOs and the ENTSO-E Verification Platform by LIBRA platform.
    a. In the case of using the SO-SO scheduling process in net position: The ENTSO-E Verification Platform which will be hosted by the Coordination Center (Swissgrid and Amprion) will be responsible for the verification of the TSOs net position schedules resulting from LIBRA platform.
    b. In the case of using the scheduling process border to border: The current SO-SO matching process could be applied.

2.6.1.5 Activation Period

Following the receipt of the LIBRA clearing results, each TSO will activate the BSPs in its control area. The description of the procedure for the activation of the local unit is out of scope of this document and is the responsibility of each TSO.

To comply with the parameters of the TERRE Standard product, which has a FAT of 30 minutes, this period will be between H-30min and H.

2.6.1.6 Delivery Period

The delivery period is a one-hour-long period, in which the TSO takes the necessary actions to deliver the reserve selected by LIBRA on its borders. These actions are the responsibility of each TSO.

2.6.2 Centralized platform Fall-back description

Case in the event that the algorithm does not converge as described in section 2.6.1.3, the following fall back procedure will be performed:

1. The LIBRA algorithm will be run taking into account the previously submitted balancing energy offers and imbalance needs, requirements and other constraints, as it was previously described but this time with ATC between all borders equal to 0;
2. The final results will be communicated to the TSOs, as described in section 2.6.1.4.

Furthermore, each TSO shall ensure that national fall-back solutions are in place in case the procedures referred to in paragraphs 1 and 2 fail.

If the balancing services procurement fails, the concerned TSOs can procure RR at a national level. Thus, if the LIBRA algorithm does not converge with ATC equal to 0, all TSOs will run their national systems, taking into account only their national balancing energy offers and imbalance needs, requirements and other constraints, and, in this case, the TSOs' needs will be satisfied only through national offers.

Other exceptional situations that require a fall-back procedure will be described in a dedicated document which will contain the rules for the operation of the platform.

Two possible solutions are under study for the implementation of the fall-back procedures.

Option 1: LIBRA clearing and fall-back procedure are performed in sequence

Figure 18: Sequent fall-back procedure

In this case, the LIBRA fall-back procedure is performed after the LIBRA clearing. A period of 10 minutes is reserved for this process, but this can be reduced during the implementation phase

Option 2: LIBRA clearing and fall-back procedures are performed at same time - in parallel

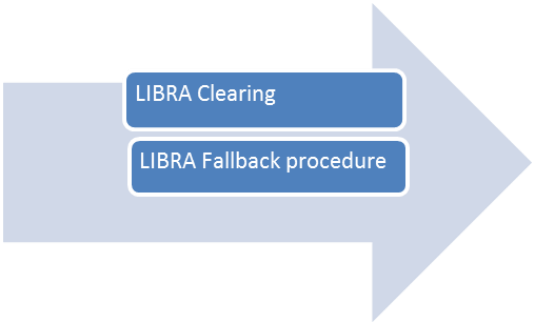

Figure 19: Parallel fall-back procedure

In this case, the LIBRA fall-back procedure is performed at the same time as the LIBRA clearing. A period of 5 to 10 minutes (maximum 10 minutes) is reserved for this process, but this can be reduced during the implementation phase.

Both options are under study, and a final decision will be taken considering the demands in terms of performance and in terms of costs, as well as the operational feasibility.

2.6.3 TSO-TSO BEGCT

The TSO-TSO GCT is a deadline for the TSOs to submit the needed LIBRA inputs.

The TSOs are requesting 15min of internal process in order to:

- Define the balancing strategy and RR need
- Submit the RR offers
- Select the unavailable bids and analyse network constraints
- Define the remaining CZ capacity and physical feasibility
- Define the Interconnection Controllability parameters

The definition of the TSO-TSO GCT is linked to the BEGCT definition (section 3.3.2).

- TSO-TSO GCT = H-45min

The TERRE TSOs would like to inform stakeholders that the operation of LIBRA could impact the TSO-TSO GCT. The TSO-TSO GCT will be confirmed during the development phase and the parallel run testing phase.
If the conditions change (for example more TERRE daily gates) this definition will be re-viewed.

2.7 Specific topics:

2.7.1 Italian market design

In the Italian electricity market, the territory is divided into Market Zones, in order to place limits on exchanges between interconnected areas with limited transit capacity. There are currently 6 "real" Market zones and 4 "virtual" Market zones.

"Real" Market zones:

- Nord
- Centro – Nord
- Centro – Sud
- Sud
- Sardegna
- Sicilia

Virtual" Market Zones:

- Brindisi
- Rossano
- Foggia
- Priolo

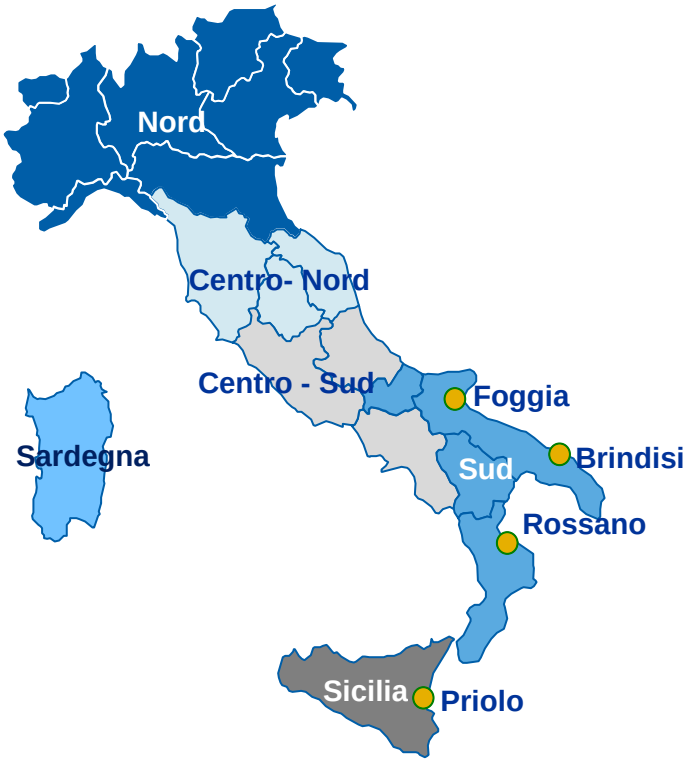

Figure 2-20: Market zones in Italy

Therefore, TERNA will communicate:

- the ATC between each neighbouring bidding zone (internal and/or external)
- the specific need (upward or downward) of each bidding zone
- the location of the offers (that will be the relevant internal bidding zone)

2.7.2 FR-CH border specificity

The XBID market implemented on FR-CH border has a 30min resolution. The ID market participants are allowed to trade 30min and 60min contracts between France and Switzerland using implicit or explicit XB capacity allocation.
Today, this border is compatible with a 30min XB scheduling step. However, at TERRE go-live, the number of daily clearing will be set to 24.

As explained in chapter 2.4, the TSOs involved in TERRE project will decrease the resolution of the XB scheduling step (target is the GL EB required date of the implementation of mFRR process). At this point the number of daily clearing for FR-CH border will increase to 48 or 96 gates. The number of daily clearings will depend on the maturity of the European balancing market at the time.

2.8 Questions for Stakeholders

Q 2.1 Do you have specific comments on the LIBRA platform description?

Q 2.2 Do you agree with the allowance of counter-activations in TERRE and their impact on the marginal price and the ID market?

Q 2.3 Which approach would you prefer to follow regarding unforeseeably rejected bids?

Q 2.4 Do you agree with the way energy losses are treated in TERRE?

Q 2.5 Do you agree with the physical feasibility description and its calculation?

Q 2.6 Do you agree with the proposed interconnection controllability through TERRE?

Q 2.7 Do you agree with the introduction of unavailable bids feature in the TERRE TSO-TSO process?

Q 2.8 What is your view on the proposed method for TSO-TSO settlement (pay-as-cleared and block energy settlement between the TSOs)?

Q 2.9 What are your views on the proposed solution for price indeterminacies?

Q2.10 Do you agree with the definition of congestion rents?

Q2.11 Do you agree with the proposal for caps/floor prices harmonization?

Q2.12 What is your point of view on the TSO-TSO XB commercial scheduling step?

Q2.13 Do you agree with the proposed definition of imbalance needs and their flexibility and elasticity?

Q 2.14 What are your views on the proposed solution for the TSO-TSO process?

Q 2.15 Do you have any further comments on the information given in this section? (Please indicate sub-chapter reference when possible)

3 TERRE TSO-BSP and TSO-BRP harmonised rules

3.1 RR Balancing product

3.1.1 Current RR balancing product

Similar to the local settlement principles of each country participating in TERRE, the RR products also differ between the TSO members. To specify the characteristics identifying the RR products, the criteria defined by ENTSO-E and ACER for standardized balancing products have been used. The overview of the deviations between the TSOs is presented in Table 8. This table presents the current situation only against the RR product, identified by TERRE. Section 3.1.2.2 will describe the local product, which has been proposed for the future, for each TSO.

Criteria (RR products only)[8]	TERRE RR product	REE	Swissgrid	Terna	RTE	REN[9]	National grid
Preparation Period	from 0 to 30 min	0-30 min	Upwards: 0-15 min Downwards: 0-15/20 min	0-30 min	0-30 min	0-30 min	Related to the technical data
Ramping Period	from 0 to 30 min	0-30 min	Upwards: 0-15 min Downwards: 0-15/20 min	0-30 min	0-30 min	0-30 min	Related to the technical data
FAT	30 min	30 min	Upwards: 15 min Downwards: 15/20 min	30 min	30 min	30 min	Related to the technical data
Minimum and maximum quantity	Minimum 1MW	"Minimum offer 1 MW Minimum for prequalification,: 10MW no maximum"	Minimum: 5MW Maximum: 100MW	up to 0	Minimum : 10 MW (1 MW limited) Maximum : 9999 MW	Minimum 0,1 MW	3MW
Deactivation Period	same as the ramping period	N/A	0	Related to the technical data	N/A	Related to the technical data	Related to the technical data
Price of the bid	the Cap & Floor prices will be compliant with the local market rules	No cap, and floor = 0 €/MWh	Upwards: 0 to 9999€/MWh Downwards:-500 to 3000€/MWh	No negative bids are allowed	Upwards: 0 to 9999 €/MWh Downward: -9999 to 9999 €/MWh	No cap, and floor = 0 €/MWh	Upwards: 0 to 9999 €/MWh Downward: -9999 to 9999 €/MWh
Divisibility	Under the responsibility of BSP Min volume = 1MW Resolution = 0,1MW Maximum Bid Size: In case of divisible bid, no max is requested	There is a possibility to offer 1 indivisible block per bid (the cheapest one)	No (only block offers)	Related to the technical data	Related to the technical data	Related to the technical data	Related to the technical data
Min delivery period	15 min or multiples of 15 min	1h	15 min	1h	Up to the BSP	1h	30 min or multiples of 30 mins
Max delivery period	60 min	4h (between ID sessions)	4h	24h	Up to the BSP	1h	Up to the BSP
Validity Period	defined by BSP but equal or less than 60 min	Between 1h and 4h	4h	From 1h to 24h	Between 4 and 6 hours	Between 1h and 4h	Defined by BSP, minimum of 30 mins
Mode of Activation	Scheduled	Scheduled	Direct activation	Scheduled	Direct activation	Scheduled	Direct activation
Minimum duration between the end of Deactivation Period and the following activation.(Recovery period)	defined by BSP	N/A	0	communicated by the BSP	Communicated by the BSP	N/A	Defined by the BSP
Location	Bidding zone	Yes. Physical location of the BSP is known (Unit Based)	Bidding zone	Bidding zone	Unit or aggregate	Physical location of the BSP is known (Unit Based or aggregate)	Physical location of the BSO is known (Unit Based)

Table 8: Local RR product description (current situation)

[8] Please refer to the definitions section in the Annex for more explanation on the criteria used

[9] The features presented here were based on products traded on other markets/agreements

3.1.2 RR Product harmonization

In this chapter we will define the RR standard product. In chapter 3.2.2.1, some TSOs explain which shape they will incentivise their connecting BSPs to deliver as close as possible to the incentivized shape of TERRE product described under section 3.1.2.1. If another shape is proposed, the BSPs or BRPs will be penalized for the deviations as explained in the related chapter.

3.1.2.1 Description of the TERRE product

The TERRE product will be the standard product for RR. In this section, the TSOs describe the characteristics of the standard product expected to be delivered by the BSPs following an activation request.

The TSOs recognise that the commercial schedules on the interconnections are blocks of energy which are integrated in the different controllers which will apply a harmonized obligatory ramp of 10min (-5min/+5min around the ISP) as requested by the NC LFC&R (Network Code Load Frequency & Reserves) for the continental Europe.
Whereas on the HVDC interconnector IFA, flows are scheduled according to a maximum ramping limit of 100 MW per minute.

These commercial schedules will be settled as energy blocks between TSOs. Table 9 presents:

- The incentivized shape characteristics of the TERRE product which the BSP is expected to deliver to the connecting TSO
- The accepted shape characteristics of the TERRE product which the BSP can deliver to the connecting TSO and is accepted by the centralized platform

The incentivized shape of the TERRE basic product is representative of the XB exchange of a scheduled trapeze, i.e. it can be activated for a fixed quarter hour(s) at hh:00-hh:15, hh:15-hh:30, hh:30-hh:45 and/or hh:45-hh:60 or a multiple of a fixed quarter hour.

The RR standard product FAT is 30 minutes.

Standard Characteristics	Incentivized shape REE, TERNA, RTE, NGET and Swissgrid	Accepted shape All TSOs
Activation Principle	Scheduled	
Preparation Period	From 0 to 25min	From 0 to 30min
Ramping Period	10 min (10 minute ramp starts 5 minutes before the nominal start of the delivery period and finishes 5 minutes after that point)	From 0 to 30min
FAT	30 min	
Minimum quantity	1 MW	
Minimum delivery period	5 min	15 min
Max delivery period	50 min	60 min
Location	Bidding Zones	
Validity Period	Defined by BSP but equal or less than 60 min	
Recovery Period	Defined by BSP	
Maximum Offer Size	• In case of divisible offer, no max is requested. • In case of indivisible offer, local rules will be implemented	
Divisible Volume	Under the responsibility of BSP (Resolution for divisible offers = 0,1MW)	
Price	Local rules for cap/floor will be implemented in case no harmonization acc. GL EB can be achieved by NRA's before entry into force of TERRE	
Time Resolution	NA	15 min

Table 9: TERRE XB product definition and shape

3.1.2.2 Definition of the local product

The local product is the application of the TERRE product (described in chap 3.1.2.1) at the TSO level (local level).

The future local products have been identified by the TSOs and are presented in Table 10. The presented differences are due to local rules which are not to be harmonized.

Criteria (RR products only)[10]	Harmonization Priority (Go live)	TERRE product	REE	Swissgrid	Terna	RTE	REN	National grid
Preparation Period	Low	from 0 to 30 min						
Ramping Period	Low	from 0 to 30 min						
FAT	Very high	30 min						
Minimum quantity	Medium	Minimum 1MW[11]						
Deactivation Period	Low	same as the ramping period	N/A	Same as the ramping period	Related to technical data	From 0 to 30 min	Related to technical data	Related to technical data
Price of the bid	High	The Cap & Floor harmonization is pending on the NRA validation[12]	Under NRA analysis[13]	No caps and floors	Under discussion	No caps no floors	Under NRA analysis	No caps no floors
Divisibility	Medium	Under the responsibility of BSP Min volume = 1MW Resolution = 0,1MW Maximum Bid Size: In case of divisible bid, no max is requested	Yes	Under the responsibility of BSP	Under the responsibility of BSP	Under the responsibility of BSP Min volume = 1MW Resolution = 0,1MW Maximum Bid Size: In case of divisible bid, no max is requested	Under the responsibility of BSP	Under responsibility of the BSP
Min delivery period	Medium	15 min or multiples of 15 min	60 min (starting point), 15 min or multiples of 15 min to be evaluated in the future	15 min	Under discussion	15 min or multiples of 15 min	60 min (starting point), 15 min or multiples of 15 min to be evaluated in the future	Under discussion
Max delivery period	Very high	60 min						
Validity Period	High	defined by BSP but equal or less than 60 min	Defined by BSP but equal (starting point) or less (to be evaluated in the future) than 60 min	defined by BSP but equal or less than 60 min	defined by BSP	defined by BSP but equal or less than 60 min	defined by BSP but equal or less than 60 min	defined by BSP but equal or less than 60 min
Mode of Activation	Very high	Scheduled						
Minimum duration between the end of Deactivation Period and the following activation.(Recovery period)	Negligible	defined by BSP	N/A	N/A	defined by BSP	defined by BSP	N/A	Defined by BSP
Location	Negligible	Bidding zone	BSP (bidding zone, location also known by the TSO)	Bidding zone	Bidding zone	Bidding zone but when activated, location known before delivery period	Unit base or aggregated base	Unit based or aggregated based (GSP or GSP group level)

Table 10: Local RR product description (future situation)

[10] Please refer to the definitions section in the Annex for more explanation on the criteria used

[11] For REE: 10MW minimum for prequalification and no maximum; SG: maximum allowed bid for block offers of 100MW; REN: under study, to be implemented before the go live.

[12] Before the harmonization of the cap and floors, the prices will be compliant with the local market rules.

[13] Depending on regulatory approval, and on provisions of European regulation.

3.1.2.3 CDS and conversion of balancing offers

As foreseen in the last version of the GL EB, each TSO applying a central dispatching model shall convert as far as possible the integrated scheduling process (ISP) bids into standard products taking into account operational security.

Integrated scheduling process (ISP) is an iterative process that uses at least integrated scheduling process bids that contain commercial data, complex technical data of individual power generating facilities or demand facilities and explicitly includes the start-up characteristics, the latest control area adequacy analysis and the operational security limits as an input to the process.

The ISP is a market based process that aims to optimize the procurement and usage of capacity and energy provided by the BSPs for the ancillary services market in the most efficient way (e.g. the same quantity may be used to procure new reserve margins and to solve a congestion).

The main services that are co-optimized through the ISP are the following:

- Procurement of reserve margins (aFFR, mFRR and RR)
- Procurement of balancing energy
- Procurement of energy to solve possible congestions
- Procurement of energy to cope with grid restriction (e.g. voltage control)

The rules for converting the integrated scheduling process bids into standard products shall:

a. be fair, transparent and non-discriminatory;
b. not create barriers for the exchange of balancing services;
c. ensure the financial neutrality of TSOs.

In general, Terna will convert the ISP bids in order to submit to the central algorithm the maximum available (increasing and decreasing) volumes compliant with the network constraints. The modification (reduction) of the offered quantities is possible only if the acceptance of the entire volume of the bid may endanger the system security.

Furthermore, in order to submit standard bids to the central algorithm, Terna will implement a methodology for the conversion of ISP bids that will take into account the following elements:

- network constraints: a security analysis will be performed to avoid the activation of a bid that will cause a grid congestion; for this analysis only the high voltage grid will be represented at nodal level;
- technical limitations of the generation and consumption facilities (e.g. minimum and maximum power, ramp-up and ramp-down limits, energy limits - all the technical and commercial data that BSPs must provide are listed in the Italian Network Code,

Allegato 22, 23 and 60): a consistency check between the result of the XBID market and the balancing offers as updated by BSPs after XZ GCT will be performed;

- no price manipulation i.e. the BSP is free to indicate a price (€/MWh) to be applied to the bids submitted to LIBRA platform.

The main impact of the conversion process is a potential reduction of the quantity submitted by a BSP. This reduction will be applied only if a potential danger for the system is detected in the security analysis performed by Terna.

Example:

In H-1, after the notification of XBID results for hour H, Terna will calculate the maximum available increasing and decreasing power that can be activated in less than 30 minutes (FAT) for each generation and consumption facility, taking into account:

- the technical limitations (minimum and maximum power, ramp-up and ramp-down limits, energy limits...);
- the program at H-30 (it includes the results of the XBID for hour H-1 and all the orders sent by Terna to the facility till H-30)
- the results of the XBID for hour H.

If we consider a Production Unit A, taking into account the information known by Terna after the notification of XBID results for hour H, we will have the situation described in Figure 3-1:

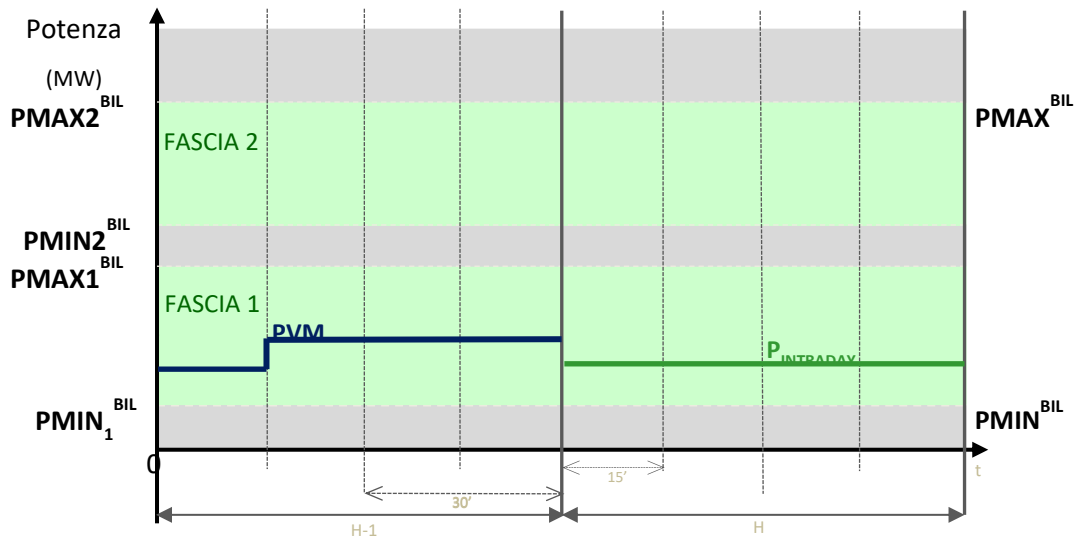

Figure 3-1: Example of conversion of balancing offers in CDS (2/2)

Where,

- $P_{INTRADAY}$ is the result for UP_A of the XBID for hour H,
- PVM is the program of UP_A at H-30 (starting of the FAT); it represents the set point of UP_A at the point in time when it should start its activation in order to implement TERRRE results for hour H and
- "FASCIA1" and "FASCIA2" are the technical limitations of UP_A.

The conversion process will calculate the maximum available increasing and decreasing power that can be activated in less than 30 minutes by UP_A, taking into account both the program of UP_A (PVM) and the XBID results for hour H (refer to Figure 3-2):

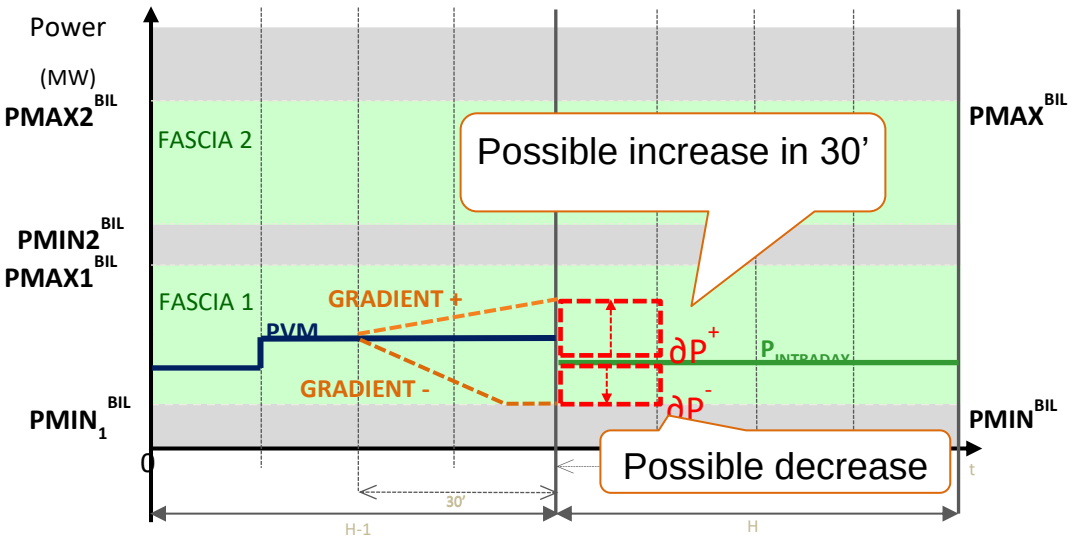

Figure 3-2: Example of conversion of balancing offers in CDS (1/2)

The prices of each quantity will be submitted by the BSP responsible for the offers of UP_A before the BEGCT.

Then a security analysis will be performed in order to avoid activation by another TSO of all (or a part) of the quantity offered by UP_A which will compromise the security of the system.

If the results of this security analysis show a potential danger for the system, the quantity that will be submitted by Terna to the LIBRA platform will be reduced.

3.1.2.4 Definition of bid formats allowed by the LIBRA platform

The following bid formats for balancing energy offers will be permitted in the LIBRA platform:

- **Divisible offers with a minimum quantity greater or equal to one**: A divisible offer is a balancing energy offer that consists of a single quantity and a single price. Its delivery period can be 15, 30, 45 or 60 minutes. The algorithm can accept a part of it in terms of quantity; however the same quantity must be accepted for the whole submitted delivery period.
- **Block offers:** A block offer is a balancing energy offer that also consists of a single quantity and a single price. Its delivery period can be 15, 30, 45 or 60 minutes. The difference between a divisible and a block offer is that the algorithm can accept either the whole quantity of the block offer or nothing.
- **Exclusive offers either in time or in volume:** Exclusive offers are balancing energy offers that satisfy the following condition: only one (or none) of the exclusive offers can be activated; hence, the activation of a sub-offer belonging to an exclusive offer excludes the activation of the other sub-offers belonging to the same exclusive offer. The exclusive offers can either be divisible or block offers. The number of sub-offers of each exclusive offer (that may be compounded of block and divisible offers) will be limited by a maximum number that will be defined during the implementation phase, based on the computation time requirements.
- **Multi-part offers in volume:** A multi-part offer is a balancing energy offer that has variable prices for variable volumes and a single delivery period. The price can either decrease or increase as the volume increases.
- **Linking offers either in time or in volume:** Linking offers are balancing energy offers that satisfy the following condition: a sub-offer of a linking offer is (not) activated if and only if another sub-offer of the same linking offer is (not) activated.

The above bid formats were presented in detail in the first TERRE consultation paper. Note that some TSOs may not allow their BSPs to offer all bid formats at the first stage of the operation of the LIBRA platform, as their local IT systems may not be ready to process all types of offers. However, to ensure fair competition and non-discriminatory conditions, all BSPs will be allowed to offer all bids formats at a later operational stage.

3.2 TSO-BSP and TSO-BRP settlement

3.2.1 Current BSP-TSO and BRP-TSO settlement procedures

Table 11 presents the current BSP-TSO and BRP-TSO settlement processes for each TSO.

Criteria (RR products only)	REE	Swissgrid	Terna	RTE	REN	National grid
Are BSPs incentivized to deliver the requested balancing energy?	Yes	Yes	Yes	For generation: as BSP's remuneration and physical BRP's imbalance adjustment are based on requested volumes, the BSP has an incentive to over deliver if imbalance price > marginal cost, under deliver otherwise. For consumption: as BSP's remuneration is based on metered values, the BSP is always incentivized to over deliver.	Yes	Yes
Are BSPs incentivized to make their delivery as close as possible to the XB exchange schedule (in power)?	No	No	Yes (we take it into account when we define the program of each UP)	N/A	No	No
Are BSPs incentivized to deliver the balancing service based on the sites appointed in the bid?	Yes					
Does the TSO have any specific expectation on the delivered power profile?	Yes (constant schedules during the hour) but no financial incentive for the power profile	No (only energy considered at present)	Yes (consistency with the schedules)	Yes (consistency with the schedules) but no financial incentive to the BSP	Yes (consistency with the schedules)	Yes (consistency with the schedules)
Does the TSO expect defect declaration in real time?	Yes (ex. ante)	Yes	Yes	Yes (ex. ante)	Yes (ex. ante)	Yes
Market Portfolio based or Unit based	Unit Based	portfolio	Unit Based	Unit and Aggregate Based	Unit and aggregate Based	Unit Based
Monitoring of Power vs. Energy products	Energy Product	Energy Product	Energy Product in 15 minutes (ISP)	Power Product	Energy Product	Power Product

Criteria (RR products only)	REE	Swissgrid	Terna	RTE	REN	National grid
BSP-BRP relationship	The BSP and the physical BRP (the BRP of the assets participating in the balancing bid) have to enter into a contract or to be the same entity to submit balancing bids.	Every BSP must have a balance group. A BSP can also prequalify units belonging to another balance group. In this case, there is no contract between the BSP and the BRP.	A BSP has to be a BRP in Italy, but there are BRPs that are not BSPs	For generation : the BSP and the physical BRP (the BRP of the assets participating in the balancing bid) have to enter into a contract or to be the same entity to submit balancing bids For DSR : the BSP and the physical BRP can be different entities and do not have to sign a contract. In this case, no BRP is attached to the BSP	BSP = BRP (the same entities)	In most cases BSP = BRP. In some cases where we have a small provider offering a specific service they act as the BSP and their BRP is the entity that owns the meter which they are connected to.
Time range for bid price definition	Marginal price of the hour	Pay as bid pricing	Pay as bid pricing	6 pricing periods per day	Marginal price of the hour	Pay as bid pricing down to a min resolution of 30 mins
Frequency of settlement (invoicing)	tbc	Once per month	Once per month	Once per month	Daily settlement and monthly invoicing	Invoicing is quarterly or once the amount owed by/to a party exceeds £500. Payment is a daily process.
Imbalance volume definition	Difference between schedule and metering	Difference between schedule and metering values	Unit based – difference between schedule and metered values	Difference between allocated injection, withdrawal, internal and external trades. Portfolio based.	Difference between metering and schedule values	Difference between metering and scheduled.
Metered volume calculation time step	1 hour (= ISP)	15 minutes (= ISP)	15 minutes (=ISP)	30 minutes (= ISP) based on 10 minutes measurements	60 minutes (= ISP) based on 15 minutes measurements	30 mins (=ISP)
BSP incentives						
Financial incentives	Yes					
Financial incentives	application of a coefficient to the non-delivered volume (BSP)	Imbalance payment	Imbalance payment	The penalty for under delivery (bigger than 20%) is 35% x Max (Spot price; Bid price). If under delivery is bigger than 20%: imbalance adjustment is based on metered volumes	Imbalance payment	Imbalance payment (some services have non-delivery penalties associated with them

Criteria (RR products only)	REE	Swissgrid	Terna	RTE	REN	National grid
Energy Post-checks (next to prequalification of bids)	Yes (in energy)	Yes but currently only for aggregation, i.e. units that belong to another physical balance group	Yes (energy over 15')	Yes (in energy over 30')	Yes	Yes
Power Post-checks (next to prequalification of bids)	No	Yes but only for aggregation	No	No	No	No
Specific Power tolerance in place	No	No (under study at present)	No	No	No	No
Consequence of non-compliance	N/A	N/A	No	N/A	N/A	N/A
Exclusion criteria	No	No (under study at present)	not related to the imbalance (technical/financial requirement)	Technical / Financial requirements	No	Technical / Financial requirements
BSPs' defect management (Centralized/decentralized) and appropriate incentives	Yes centralized	Centralized Incentives: Imbalance payment	Centralized - Imbalance payment	Centralized	Centralized	Centralised
Frequency of bidding	Depends (RR opened between ID sessions, and when there is a high imbalance foreseen)	Every 4 hours	Every 3 hours	Every hour	After ID sessions	Depends, units can update bids from more than 24 hours ahead up to gate closure one hour before
Additional concepts participating in the balancing market	No	The balancing market is open to all technologies. Demand response, photovoltaics, batteries, wind currently participate	Not yet	The balancing market is open to all technologies	No	The balancing market is open to all technologies
Bid Requirements						
Limitations to quantities	No	Maximum: 100MW Minimum: 5MW	No	Minimum : 10 MW (1 MW limited) Maximum : 9999 MW	No	No
Limitations to pricing	Floor = 0 €/MWh	Upwards: 0 to 9'999€/MWh Downwards:-500 to 3 000€/MWh	Negative bids are not allowed	Upwards: 0 to 9999 €/MWh Downward: -9999 to 9999 €/MWh	Floor = 0 €/MWh	No
FAT	30 min	Minimum: 15 minutes upwards and 15/20 minutes downwards	Related to the technical data	Related to the technical data	Related to the technical data	Related to the technical data
Duration of the bid	1hour - 4 hours	15min - 4 hours	Up to the BSP	15' - x hours	1hour - 4 hours	Up to the BSP

Criteria (RR products only)	REE	Swissgrid	Terna	RTE	REN	National grid
Divisibility of bids	Yes	No	Up to the BSP	Up to the BSP	Yes	Yes, technical constraints can be declared by the BSP
Possibility for the TSO to recall/cancel an activation order after it has been sent to the BSP	Yes	Yes, respecting the minimum duration time	Yes	Yes	Yes	Yes an "undo" price is provided by the BSP. Any undo will have to respect their technical data
Settlement price	Marginal price	Pay-as-bid	Pay as bid	Pay-as-bid	Marginal Price (and pay as bid, if necessary for security reason)	Pay-as-bid
Methods of procurement of RR energy	Market based	Market based	Integrated Scheduling Process (Market based)	Market based	Market based	some market based, some integrated scheduling process
Imbalance adjustment	requested block	requested block	We take into account every command (for balancing, congestion solving….) sent to the BSP	Generation: requested volume Consumption: metered volume In case of under delivery bigger than 20% : metered volume for all	requested block	Yes. But we have some services from smaller providers which are not currently adjusted for imbalance
Financial penalization on marginal price	Yes	No	Yes	No, based on bid price	No	Yes
Performance control/monitoring method (metered volume calculation)	Yes	Yes For aggregation, i.e., units that belong to another physical balance group	Yes	Yes	Yes	Yes
Reserve requirements	To cover the imbalance foreseen	~400MW positive, 270MW negative (dimensioning varies on a weekly/daily basis based on a stochastic approach, both mFRR and RR)	To cover the imbalance foreseen	500 MW of capacities available in 30'	To cover the imbalance foreseen	Calculated based on largest possible loss on the system

Criteria (RR products only)	REE	Swissgrid	Terna	RTE	REN	National grid
Publication of BSM data	Volumes and prices of balancing bids, presented and accepted, imbalance prices	Activated volume and weighted average price separately for up and down regulation, 15 min values	Activated volume and weighted and marginal price of upward and downward activations of balancing energy, for each Zone	Marginal and weighted average price, activated volumes per bid type and activation purpose, imbalance price, …	Activated volume and marginal price of upward and downward activations of balancing energy	Volumes and prices of balancing bids accepted, imbalance prices
System imbalance calculation approach	Net volume of activated RR/mFRR/aFRR in the hour	N/A	Currently net volume of activated RR/mFRR/aFRR in the ISP	Net volume of metered energy (FCR/aFRR/mFRR/RR/unintended exchanges)	Net volume of activated RR/mFRR in the hour	Net volume of activated energy
BRP incentives	Imbalance price	Imbalance price	Imbalance Price	Imbalance price	Imbalance price	Imbalance Price
Imbalance settlement period	60	15	15	30	60	30
Relative positioning of GCTsfor RR	1 hour	1 hour	Between 3 and 7 hours ahead of the Delivery Hour	1 hour	1 hour	1 hour
Number of Imbalance Portfolios and prices	Two	One	One unit = one portfolio (so a BRP can have several portfolio)	One	Two	One
Time before real Time for BRP to carry out a physical re-schedule in Internal ID market	Min 1 hour	15 min	Min 4 hours	Min 1 hour	1 hour	Min 1 hour
Main imbalance pricing mechanism	Dual price (weighted average price / Spot price)	Dual price	Dual price	Single price	Other	Single price
Special imbalance pricing mechanism	No	No	BRPs that are not BSPs	No	No	No
Single vs. dual pricing	Dual Pricing	Dual Pricing	Dual price	Single price	Other	Single price

Table 11: TSO-BSP/BRP Settlement (current situation)

3.2.2 RR market harmonization: TSO-BSP and TSO-BRP settlement and incentives

The TSO-BSP settlement refers to the definition of the financial flows between TSOs and BSPs whose bids have been activated in the LIBRA platform. The TSO-BSP settlement scheme is a determinant of the incentives that are perceived by BSPs, along with the legal and contractual requirements that apply to them. We consider that a certain level of harmonization in the TSO-BSP settlement is necessary in order to ensure fair and non-discriminatory market conditions and rules between national markets, as recital 7 of the GL EB sets out that the terms and conditions for balancing activities must ensure adequate competition based on a level playing field between market participants.

On the other hand, the TSO-BRP settlement includes the settlement of the imbalances of the system. It is part of the national terms and conditions that the TSO has to propose and implement according to the GL EB (please refer to Article 28. Terms and Conditions related to Balancing). Although it is a national issue, the GL EB requires that some features of the imbalance settlement are harmonized at some point in time. The GL EB established clearly which aspects need to be harmonized, and foresees a process for doing so. In order to solve an imbalance, different balancing services can be used – not only RR, but also mFRR, aFRR and imbalance netting. Thus, the TSO-BRP settlement exceeds the scope of TERRE project, which leads only with RR energy. This is why the details of the TSO-BRP settlement will not be included in this chapter, but will be part of the national implementation of the GL EB in each system. Nevertheless, as shown in Table 1, balancing energy under or over delivery can result in additional BRP's imbalances and thus impact the TSO-BRP settlement. This specific aspect will be discussed in the present document.

3.2.2.1 Harmonization of settlement rules

The settlement rules that will be harmonized across all TERRE TSOs when LIBRA goes live are summarized below:

- BSPs should be settled with pay-as-clear: since the TSO-TSO settlement is based on pay-as-clear, the TSO-BSP settlement should also be consistent with this. This was also the feedback of the stakeholders from the first consultation paper and one of the aspects that was requested to be harmonized, i.e., the TSO-BSP settlement shall be consistent with the TSO-TSO settlement. Therefore, the TSO-BSP settlement will be calculated on the Cross-Border Marginal Price (XBMP) methodology that is also used for the TSO-TSO settlement (please refer to 2.2.6). Note that this proposal needs to be approved by the NRAs on a local level.
- BSPs will be settled for the requested balancing energy: TSO-BSP settlement will be based on blocks and on the requested balancing energy; BSPs will not be settled based on the metered physical delivery but based on the requested balancing energy.

The settlement rules that will be harmonized by Swissgrid, TERNA, RTE, NGET and REE when LIBRA goes live are summarized below:

- BSPs should be incentivized to physically deliver as close as possible to the XB exchange schedule: any deviation of the delivered balancing energy delivery from the XB exchange schedule will result in a power imbalance within the RR providing area. The XB exchange in continental Europe has currently 10 minutes up and 10 minutes down ramping, has hence a trapezoidal shape. Figure 3-3 illustrates the physical scheduled XB exchange assuming a 15 minute XB scheduling step.

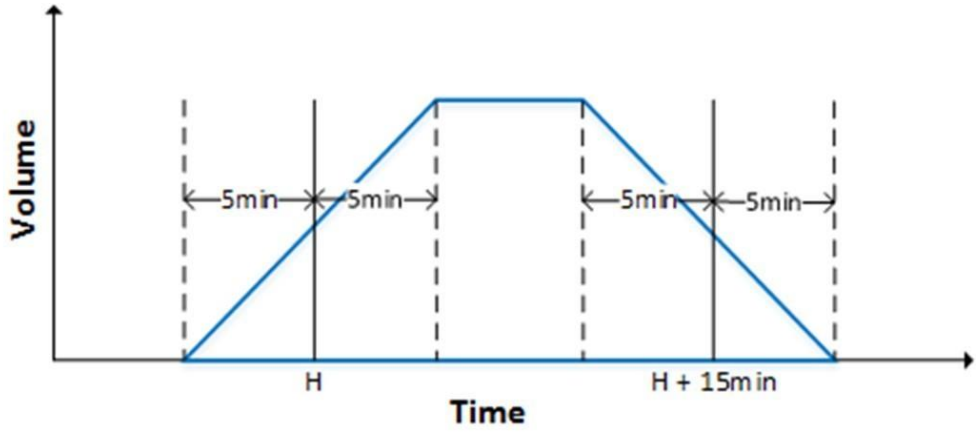

Figure 3-3: XB exchange for a Delivery Period of 15 minutes

If the physical delivery of the BSP providing RR deviates from the XB exchange schedule, the RR exchange will result in a power imbalance within the area that this BSP is connected to, as depicted in Figure 3-4. The additional imbalances have then to be solved by the connecting TSO by using mFRR or aFRR. A mismatch between the XB exchange schedule and the BSPs power delivery may hence lead to higher mFRR and/or aFRR imbalance needs and higher balancing energy and/or capacity costs. Therefore, BSPs should be incentivized to physically deliver as close as possible to the XB exchange schedule. This can be achieved either through different settlement schemes or incentives. We recognise that this schedule does not accurately represent the exchange schedule across HVDC links, and further consideration is needed to ensure that the TERRE XB scheduling on IFA between RTE and NGET is compatible with the current scheduling methodology.

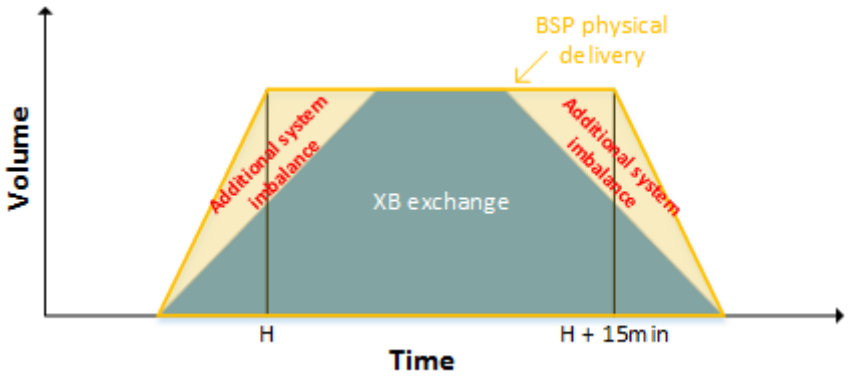

Figure 3-4: Different BSP physical delivery than the XB exchange

To clarify the expected physical delivery, we consider an example of a market participant with a DA schedule equal to 100MW for hour H and 150MW for hour H + 1, and an accepted RR offer of 50MW for hour H and 100MW for hour H+1. We assume that the DA schedule is delivered in block (in Switzerland, the BRP schedule changes are expected to be done with/including the 10 min ramps). Figure 3-5 presents the exact expected delivery.

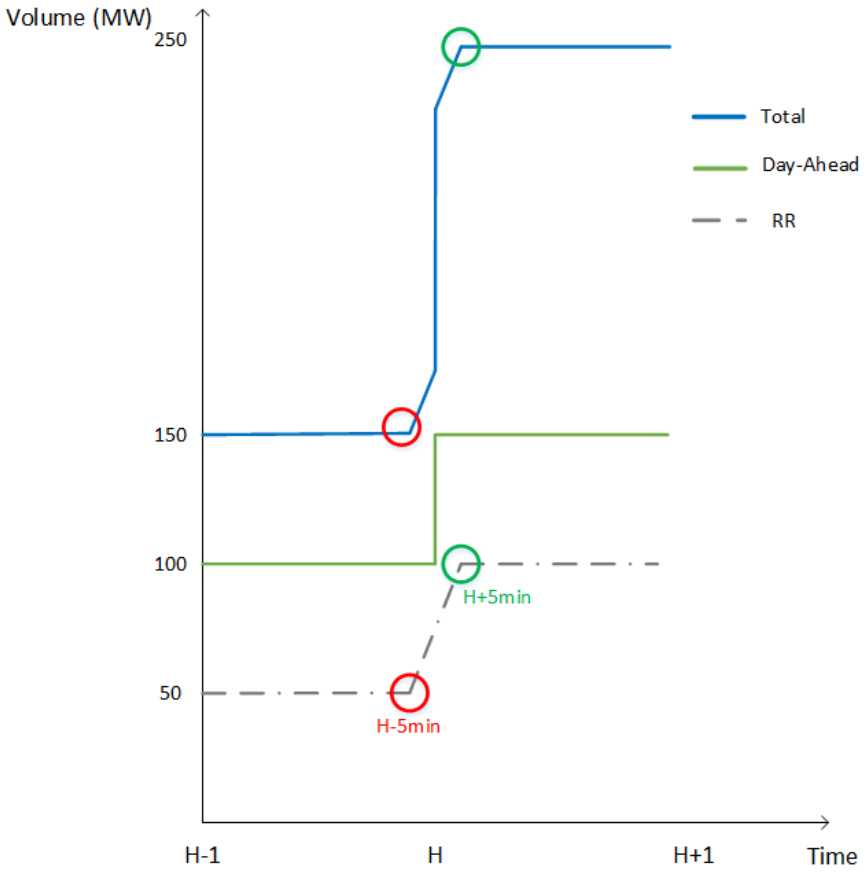

Figure 3-5: Example: expected physical delivery

3.2.2.2 Harmonization of market parties' incentives

The GL EB states that the terms and conditions related to balancing (for BSPs and BRPs) are defined by each TSO (Art 18.1), so at the end will be approved by each NRA pursuant to Art 5.4. However, it is foreseen (Art 18.3) that a certain level of harmonization and coordination is needed between the TSOs in order to seek for a level-playing field for market parties and for an efficient balancing market.

The harmonization of market parties' incentives is achieved in the GL EB through:

- The frameworks for harmonization of terms and conditions included in the proposal of framework of the European platforms (Art 19 to Art 22)
- The coordination between TSOs and other parties included in the terms and conditions (Art 18)
- The principles stated for BSPs (Art 16 for terms and conditions for BSPs, Art 24 for GCT, Art 30 for pricing of balancing energy, and Chapter V for Settlement rules, among others)
- The principles stated for BRPs (Art 17 for terms and conditions for BRPs, and Chapter V for settlement rules, among others)

TSOs may offer incentives to their local BSPs and/or BRPs, through penalties or market regulation rules, in order to (a) comply with the harmonized rules described in the previous section, (b) ensure non-discriminatory market conditions and (c) have a better control over the system. The principles governing the aforementioned incentives are summarized below:

- BSPs should not be incentivized to deliberately provide an under or over delivery of the requested profile of balancing energy: the TSO-BSP, and where relevant the TSO-BRP settlement schemes should ensure that the market parties are incentivized to deliver the balancing energy volumes requested by the TSOs. This will be achieved using two different methods:
    - **Model A**: this settlement scheme is directly linked to BSPs. A balancing energy deviation price (that could be the imbalance price) will be calculated for each activation and will be charged for the amount of energy that was not delivered by the respective BSP.
    - **Model B**: other TSOs will incentivize their BSPs to deliver the requested volume and profile through penalizing the BRPs with imbalance price.
    - **Model C**: gives the same incentives as Model B. The difference is the expected delivered incentivized shape of the offer.

  Please note that the metering is performed differently in the different countries.

Example 1

Firstly, we present an example of a BSP that delivers the requested balancing energy volume with infinite ramps, instead of the 10 minute ramps. Therefore, as illustrated in the Figure 3-6, the total energy delivered by the BSP is equal to E5, and E1-E4 represent the deviations from the expected delivered energy.

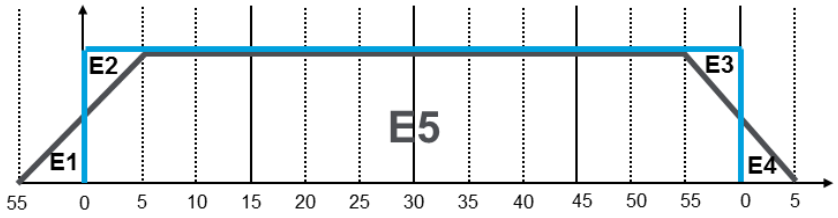

Figure 3-6: Example: delivery (blue) with infinite ramps

Table 12 and Figure 3-7 presents the main settlement scheme as well as the different financial flows between the TSO and the BSPs and BRPs for Model A, B and C respectively, due to the non-delivery of the expected profile. We observe that through different means, the TSOs are trying to give the same incentives. Note that aligning the balancing energy deviation prices with the imbalance prices would not provide the same incentives, considering the existing differences in the imbalance settlement processes of the TERRE TSOs.

	Model A (Applied by RTE, TERNA and National Grid)	**Model B (Applied by Swissgrid and REE)**	**Model C Applied by REN**
Main settlement			
TSO → BSP	E5·TERRE marginal price[14]	E5·TERRE marginal price	E5·TERRE marginal price
Penalties/Incentives			
Overall TSO → BSP/BRP	The same for both models, if Imbalance Price (IP) would be replaced by the Balancing Energy Deviation Price (BEDP)		
TSO → BSP	$E2 \cdot BEDP_+ + E3 \cdot BEDP_+$[15]	NA	NA

[14] The XB marginal price is a 15 minute price; in the presented table, for the sake of simplicity a single price is included for the whole hour

[15] For systems with shorter ISP than one hour, E2 and E3 will be charged with different imbalance prices

BSP → TSO	$E1 \cdot BEDP_{-} + E4 \cdot BEDP_{-}$[16]	NA	NA
TSO → BRP	NA	$E2 \cdot IP_{+} + E3 \cdot IP_{+}$[17]	NA
BRP → TSO	NA	$E1 \cdot IP_{-} + E4 \cdot IP_{-}$[18]	NA

Table 12: Example: settlement for both models

BEPD+: Balancing Energy Deviation Price for positive deviation

BEPD-: Balancing Energy Deviation Price for negative deviation

IP+: Imbalance Price for positive imbalance

IP-: Imbalance Price for negative imbalance

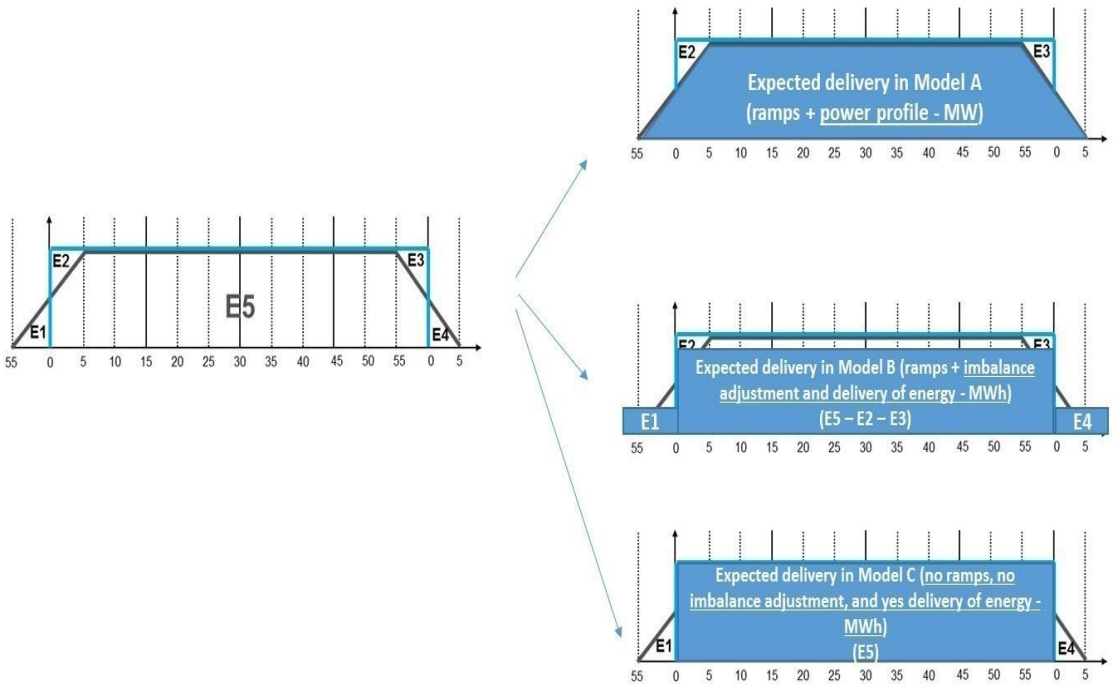

Figure 3-7: Model explanation

[16] For systems with shorter ISP than one hour, E1 and E4 will be charged with different imbalance prices

[17] For systems with shorter ISP than one hour, E2 and E3 will be charged with different imbalance prices

[18] For systems with shorter ISP than one hour, E1 and E4 will be charged with different imbalance prices

Example 2

We also consider an example of a BSP that under-delivers with regard to the requested balancing energy. As illustrated in the Figure 3-8, the total energy delivered by the BSP is equal to E2, and the requested energy was equal to E1.

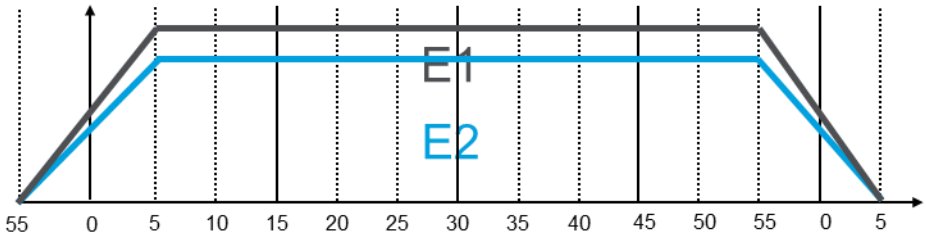

Figure 3-8: Example: BSP under-delivery

Table 13 presents the main settlement scheme as well as the different financial flows between the TSO and the BSPs and BRPs for Model A and B respectively, due to the under-delivery.

	Model A	Model B
Main settlement		
TSO → BSP	E1·TERRE marginal price	
Penalties/Incentives		
Overall TSO → BSP/BRP	The same for both models, if Imbalance Price (IP) would be replaced by the Balancing Energy Deviation Price (BEDP)	
TSO → BSP	NA	NA
BSP → TSO	(E1-E2)·BEDP-	*[19]
TSO → BRP	NA	NA
BRP → TSO	NA	(E1-E2)·IP-

Table 13: Example under-delivery: settlement for both models

[19] In some systems, additional penalties may exist due to under-delivery

- Activated offer volume should be delivered by the assets corresponding to the activated BSP offer for unit based and aggregate based systems. TERRE TSOs will allow different types of bidding unit in their respective systems. These unit types include:
  - **Unit Based**: Where a balancing energy offer is linked to a single asset with a specified grid location
  - **Aggregate based**: Where each balancing energy offer is associated with one or more assets, and their physical grid location is known to the connecting TSO

  The unit types accepted by each TSO will differ according to current processes and system characteristics. In all of these cases, the TSO expects that the requested balancing energy will be delivered by the assets corresponding to the BSP unit. For both unit based and aggregate based activations, the TSO must ensure that the delivery of these offers will not lead to congestion. In the case of portfolio based activations, alternative methods exist outside of the RR process to manage congestions and this principle is not relevant.
- The settlement scheme should not favour larger nor smaller market participants over others.
- BSPs should be incentivized to report any defect as soon as it is known: the balancing energy offers are firm. However, BSPs with accepted balancing offers that cannot deliver the requested balancing energy due to technical reasons shall be incentivized to communicate it as soon as possible to the connecting TSO. In this way, the TSO can have a better control of the system and take remedial actions at the lowest cost.

Finally, we stress that a wide range of physical assets should be allowed to participate; assets with different balancing energy delivery profiles should be allowed to participate in the RR market, as long as the FAT equal to 30 minutes can be respected. Therefore, assets with very fast ramping capabilities, e.g., hydro units, as well as assets with slower ramping capabilities, e.g., thermal units, should be allowed to participate. Each TSO will define a range of different accepted power/energy delivery profiles. The power delivery profile of the BSPs activated through TERRE will be either controlled in real-time or offline separately for each activation request, or will be controlled during the prequalification process.

3.2.2.3 Harmonization deviations

As it has been explained before, the TSOs aim to harmonize the incentives provided to the market parties as much as possible in order to guarantee an efficient functioning of the RR balancing markets and a level playing field in all the systems. However, the way these incentives are provided in the different systems may be conditioned by structural characteristics (with a wider scope than TERRE project) and thus may present some deviations that cannot be solved by TERRE project. These deviations are presented and explained below.

- Balancing in terms of power (model A) and balancing in terms of energy (model B and C): some TERRE TSOs balance their system in terms of power, i.e. monitor the exact power profiles delivered by all BSPs, whereas other TSOs balance their system in terms of energy, i.e. monitor the deviations from the requested energy for BSPs or BRPs. This aspect will not be harmonized within TERRE, as it is related to different but well established operational philosophies, and changes would be challenging and would require many years. Note that several harmonization deviations, are based on these two different operational philosophies.
- Relationship between the BSP and the BRP: as presented in Table 11, currently different schemes exist with regard to the relationship between the BSP and the BRP; some systems have a very straight relationship BSP-BRP, whereas in other systems the behaviour of the BSP is independent from the financial responsibilities of the BRP. In the first case, the incentives will be **more put on the BRP side** through imbalance prices (knowing that the straight relationship BSP-BRP will make at the end that the incentive is translated towards the BSP), whereas in the second case the incentive is **put directly on the BSP** through balancing energy deviation settlement.
- Time step or the control on the provision of the balancing service:
    - In those systems with straight relationship BSP-BRP, the control of the provision is performed across the **imbalance settlement period**[20] (ISP, towards the BRP), i.e. approaching more to an energy schedule of the BRP.

[20] Please note that currently there are different ISPs across the TERRE Countries. The Imbalance Settlement (TSO-BRP) is out of the scope of this document as it implies all the TSOs of the UE and not only the TERRE TSOs (or TSOs using RR).
The harmonization of the imbalance settlement rules (ISP, main components of the Imbalance Price) will be tackled together with all the TSOs of the UE and in the timelines defined by the GL EB. See more details in the Annex.

- In those systems with independency between BSP and BRP the control of the provision may be performed across **another time step** (usually lower than the ISP), i.e. approaching more to a power profile of the BSP.

- Balancing energy deviation settlement prices: This refers to the settlement applied to the BSP and/or the BRP resulting from the difference between the requested shape/schedule of the BSP/BRP and the physical delivery of the service. If applied to the BSPs, this balancing energy deviation settlement price should be consistent with the bid presented by the BSP (in some cases it is directly the bid price, whereas in others it is the marginal price), and if applied to the BRP it will be the imbalance price. In all the cases, the intention is to look for a correct functioning from the balancing markets; it shall give correct incentives to BSPs/BRPs and shall not discourage BSPs to bid balancing energy.
- Imbalance adjustment: the imbalance adjustment of the BRPs will not be implemented in the same way by all TSOs. Specifically, depending on the relationship between the BSP and the BRP, some TSOs will adjust the BRPs based on the requested balancing energy volumes, whereas others will adjust the BRPs based on the metered balancing energy volumes, i.e. the physical delivery of the respective BSPs.

It is important to note that, due to the structural differences in the BSP-BRP relationship and imbalance settlement (ISP, portfolios, price), an alignment of the balancing energy settlement rules (for instance, defining balancing energy deviation as BRP's imbalance in all TERRE countries) would not result in harmonized incentives for market parties the next few years. The focus should be on having consistent incentives, regardless if they are provided through the BRP or directly to the BSP.

3.3 Balancing GCT for RR

3.3.1 Current description of the balancing GCT for RR

This section describes the current balancing GCT for the RR product for each TERRE TSO. The highlighted differences will be discussed in section 0 to identify a common and harmonized understanding.

France: Currently France only uses specific products. Therefore there are no specific GCT for RR. The general process is organized around 24 GCTs per day with a lead time of one hour. This means that today the balancing energy bids can be updated, at the latest, one hour before real time. The activation conditions depend on the technical characteristics of the providing units or groups.

Italy: Currently margins for RR (and FRR) are procured in D-1 (Dispatching Services Market ex-ante) through the integrated scheduled process. There are also five additional integrated scheduled process sessions during a day that allow BSPs to update the prices of their bids. Technical data can be updated at any time by the BSPs. Offers are submitted in power and activated through the integrated scheduling process (common merit order).

Portugal: The RR process covers the periods existing between the 6 daily ID MIBEL sessions. The offers are submitted in power and activated through a common merit order (downward and upward). After each market (DA and ID), agents are obliged to update their offers taking into account all the available power and the schedules in the previous markets. The agent can update its schedules and offers until 60 minutes before real time.

Spain: currently, there are 6 ID implicit sessions in MIBEL (Iberian Peninsula: Portugal + Spain). The RR process covers the periods existing between the ID sessions (the activation of the energy can last from 1 hour to several hours). The RR market (called "deviation management" in the Spanish system) is opened when, between two consecutive ID markets, there is a high foreseen imbalance[21]. There is no fix GCT for reception of RR balancing energy bids as the imbalance can be identified at any time between the ID sessions.

Switzerland: currently, mFRR and RR are directly activated through a CMOL. The submitted bids cover 4 hour blocks and can be activated from 15 minutes to 4 hours. There are 6 GCTs per day, one for each 4 hour block. The GCT is one hour before the delivery of each 4 hour block. The delivery of positive balancing energy can be requested with a lead time of at least 15 minutes, irrespective of the time of the request, whereas the delivery of negative balancing energy can be requested only at the full quarter hour with a lead time of at least 20 minutes. Negative balancing energy from free bids or bids that are pre-contracted for capacity in the daily auctions, can also be requested with a lead time of at least 15 minutes.

[21] Please check Spanish Operational Procedure 3.3

UK: The UK currently only uses specific products for balancing purposes, hence there is no specific GCT for RR. The existing process has s that we have 48 gate closures per day (every half an hour) with each gate closing one hour before real time. Balancing energy bids must be received by National Grid by these gate closures in order for them to be updated. The following 60 minutes is then used by the TSO to perform residual balancing and system optimisation.

3.3.2 RR TSO-BSP Balancing GCT

The BEGCT is the deadline for Standard RR Balancing bids submission to the TSOs by the BSPs.

Due to the constraints on the balancing market and the important reduction of the balancing window, the TSOs propose the BEGCT to be H-60min. H is equal to the start of the delivery period.

3.4 Questions for Stakeholders

Q 3.1 Do you have any specific comments regarding the criteria used to characterize the current local RR balancing product profiles and formats allowed by the LIBRA platform?

Q 3.2 Do you have any specific comments regarding the criteria used to characterize the current local BSP-TSO and BRP-TSO settlement procedures?

Q 3.3 Do you see a possible competitive advantage arising from delivering either the trapeze or block offer?

Q 3.4 Do you agree with the description of the current local GCT situation for RR?

Q 3.5 Do you have any specific comments regarding the definition of the BEGCT and the proposed timings, namely the proposal of the BEGCT to be H-60min?

Q 3.6 Apart from the elements stated in Chapter 3, do you think other TSO-BSP and TSO-BRP elements should be harmonized? If yes which ones?

Q 3.7 Following the information provided in Chapter 3, can you indicate your top three harmonization priorities?

Q 3.8 Do you have any additional comments regarding Chapter 3 content? (Please indicate sub-chapter reference when possible)

4 Transparency

In this section, the TSOs present the current requirements of the GL EB and the transparency regulation which will be applied for the RR process. The requirements for the reporting to the NRAs (e.g. imbalance need) are out of scope of this document and will be discussed through REMIT group or bilaterally on a national basis.

4.1 GL EB requirements

4.1.1 Common Publication

Transparency is a key concept in the GL EB to ensure a non-discriminatory, efficient market. In this document we deal only with transparency considered in the framework of the GL EB. The following suggestions are in line with ***article 12 Publication of information*** of the network code for the use of RR products.

TERRE TSOs are keen to use the existing ENTSO-E transparency platform, by replacing the current published data by a common publication of the following date, time and data:

- **as soon as possible but no later than 30 min after the delivery period of an RR product (i.e. 1h30 after real time for RR),** detailed information on the RR bids submitted to TERRE:
    1. The type of product, here RR
    2. Its validity period between 15 min and 1 hour with 15min resolution
    3. The offered volumes of each bid for the given TERRE period
    4. The price of the offer
    5. A tag for the unavailable bids
    6. information on whether the bid was converted from a specific product or from an integrated scheduling process
    7. information regarding how balancing energy bids from specific products or from integrated scheduling process have been converted into balancing energy bids from standard products
- **as soon as possible but no later than 30 min after the delivery period of an RR product (i.e. 1h30 after real time for RR),** aggregated information on the RR bids submitted to TERRE:
    1. total volume of offered RR balancing energy bids, standard and specific confounded for upward and downward separately
    2. total volume of offered and activated balancing energy bids separately for standard and specific products; per type of reserves, for upward and downward separately
    3. volume of unavailable bids separately per type of reserves;

Data	Energy bids	Calculated	Upward/ down-ward	Type of reserves	Stand-ard /spe-cific
1	Offered and activated	Separated	✓		
		Aggregated		✓	✓
2	Offered and activated	Separated	✓	✓	
		Aggregated			✓
3	Offered and activated	Separated	✓	✓	✓
		Aggregated			
4	Unavailable	Separated	✓	✓	✓
		Aggregated			

Table 14: Publication per type of reserves

For the detailed information, the bids should be anonymized and no ID provider should be given alongside the offer (in order to prevent from a potential competitive advantage or disadvantage of some BSPs).

4.1.2 National publication

The elements that are not belonging to the common list of data can be published on a local level, through the current means of individual TSOs. We present below what is currently published on local level for each zone.

RTE:

- Daily margins: the margins represent a volume of capacity available for RTE over and above the operating schedule capable of being used to cope with generation or consumption contingencies. They are consequently one of the essential components of system control under safe operating conditions.
- Trends and balancing prices
- Daily balancing energy volume (for upward and downward separately, for power system balance and congestion separately)
- Daily capacity/price curve
- Imbalance settlement price
- Insufficient offers : list of message(s) sent to the Balancing Actors
- Balancing Mechanism Reports
- Reserves: procured reserves, accepted and activated offers

XB Balancing: BALIT and IGCC

- National reference load curve: This curve is corresponding to net extraction by the Public Distribution Network on the Public Transmission Network, calculated on the basis of metering data measured at RTE HV/MV delivery point substations.
- National Profiling Imbalance: this curve corresponds to the difference between net extraction of Public Distribution Network (PDN) on the Public Transmission Network

metered by RTE and aggregated Balance Responsible flows on PDN calculated by Grid Operators by the way of remote metering, profiling and estimating losses.

- National alignment coefficient: this curve is corresponding half-hour by half-hour points to the coefficient that correct the consumption estimated by the Grid Operators on Public Distribution Network for all Balance Responsible flows in order to adjust her to the real level.
- National Residual load curve: the energy correction made after the spatial alignment generates a difference on every half-hour period between the correction of BRs's balances and the National Reference load curve. Its annual amount is called Residual financial amount and is charged to every BR in pro-rata of its estimated consumption.

Swissgrid

The next elements are published for every 15min period:

1. weighted average price for upward activations
2. weighted average price for downward activations
3. total volume of upward activations
4. total volume of downward activations

NG

Aggregated balancing data is reported via the Balancing Mechanism Reporting Service (BMRS). This service publishes data relating to the Balancing Mechanism, Settlement and the market in general. This includes data provided by National Grid relating to balancing actions and indicative data relating to balancing and Settlement, including indicative data for each settlement period shortly after its completion. All of the data published on the BMRS is indicative data, calculated from the information available at the time. The main data relating to system balancing that is included on the BMRS website are as follows:

- Market Data: Market depth and activity
- System Imbalance prices
- Detailed pricing of system actions
- XB Balancing data
- SO – SO trades and trade prices
- Balancing Mechanism Data (Balancing Services Adjustment Data and Non-BM instructed volumes)
- Generation Forecasts, actual generation and unavailability of generation and production units
- Forecast demand, actual demand and unavailability of consumption units.

REE:

All the details are included in Spanish Operational Procedure 9).

The following information is published and refreshed in real time, or as soon as it is available:

- Updated demand forecast in the Spanish system
- Updated forecast for wind and solar production in the Spanish system
- Unavailabilities of programming units and consuming units higher than 100MW, and global aggregated unavailabilities updated net position (results/global schedule) of the Spanish system after each market
- Updated schedules (result) of the balancing services (separation RR, mFRR, aFRR)
- Aggregated offer curve and activated volume and marginal price of the balancing services (separation RR, mFRR, aFRR), per direction (upwards/downwards)
- Imbalance price (upwwards/downwards)
- Updated ATC in real time Updated results of XZ capacity allocation and XB schedules after DA and ID markets in the Spanish interconnections
- Average hourly flow on each Spanish interconnection (ex post)

XB balancing (BALIT):

- XB balancing bids submitted by the Spanish system
- XB balancing bids (external) activated by the Spanish system, per interconnection
- XB balancing bids (Spanish) activated by other systems, per interconnection

REN:

All the details are included in the "Manual de Procedimentos da Gestão Global do Sistema do Setor Elétrico". The following information is published and refreshed in real time, or as soon as it is available:

- Aggregated offer curve and activated volume and marginal price of the balancing services, per direction (upwards/downwards)
- Updated schedules (result) of the balancing services.
- Imbalance price (upwwards/downwards)
- Forecasted yearly, monthly, weekly and daily ATC
- Forecast of production and consumption;
- Updated ATC in real time Updated results of XZ capacity allocation and XB schedules after DA and ID markets
- Average hourly flow on each interconnection (ex post)
- Unavailabilities of programming units

XB balancing (BALIT):

- XB balancing bids submitted by the Portuguese and Spanish system
- XB balancing bids activated by the Portuguese system.

TERNA:

- **Load** - The "Load" section includes data related to load forecast with the following levels of detail:
    - Actual Load
    - DA load forecast
    - Month-ahead load forecast
    - Year-ahead load forecast
    - Year-ahead forecast margin including peak load forecast
- **Transmission and Interconnection** - The "Transmission and Interconnection" section includes data related to the status of the transmission grid with the following levels of detail:
    - Report on developments in the transmission grid
    - Planned outages in the transmission grid and on interconnections
    - Year ahead forecasts of available transmission capacity
    - Month ahead forecasts of available transmission capacity
    - DA available transmission capacity
    - Details on actual outages in the transmission grid
    - Capacity offered, requested, assigned
    - Total capacity nominated
    - Capacity allocated, capacity price, congestion income
    - Reasons and effects of actions taken by TSOs
    - Aggregated realised commercial and physical flows per interconnection

- **Generation** - The "Generation" section includes data related to generation with the following levels of detail:
    - Installed generation capacity
    - Ex ante information on planned outages of generation units
    - Ex ante aggregated information on scheduled generation
    - Filling rate of the water reservoirs
    - Forecast and actual generation of wind power
    - Ex post information on unplanned unavailability of generation units
    - Ex post data on the actual generation
- **Balancing**

  The "Balancing" section includes data regarding the Dispatching Services Market . This spot market is the tool through which Terna acquires its supply of resources for such dispatching services as solving congestion, building adequate storage margins and keeping the balance between injection and withdrawal. Acquiring the above-mentioned services is necessary for safely managing the National Electricity System, guaranteeing the proper grid standards, such as voltage and frequency.
  Submitting offers on the Dispatching Services Market occurs in a single session immediately following the announcement of the results of the Adjustment Market (MA) [from 2:30 pm to 4:00 pm of D-1] while the selection of the quantity to be accepted is carried out by Terna in two subsequent phases:
  Planning phase or ex-ante Dispatching Services Market [day D-1 from 4:00 pm to 9:00 pm]
  Real time or ex-post Dispatching Services Market [day D]
  The market structure established by the existing regulatory provisions does not allow differentiation of offers according to the type of service and also establishes the publication of real time data within the fifteenth day of the m+2 month.

4.2 Transparency Regulation

The current requirements of balancing data publication requested by the regulation 543/2013 (the Transparency regulation) are the following:

- **Rules on balancing** (processes and methodologies)
- **Procurement of balancing reserves**: Amount and price of the reserved capacity of balancing reserves (at the latest 2 hours before the next procurement process takes place and no later than one hour after the procurement process ends)
- **Volumes of accepted aggregated offers** (no later than one hour after the operating period)
- **Procurement of balancing energy:**

- Volumes of activated balancing reserves (no later than 30min after the operating period)
- Prices of activated balancing reserves (no later than one hour after the operating period)

- **Imbalance settlement:**
  - Imbalance prices (as soon as possible)
  - Total aggregated volume of the imbalance (no later than 30min after the operating period)
  - Monthly financial balance (at the latest on the last calendar day of M+3)
- **XB balancing:**
  - Aggregated volumes of offers for XB balancing activation (no later than one hour after the operating period)
  - Prices for XB area balancing for bids and offers (no later than one hour after the operating period)
  - Volumes of XB area balancing energy activated (no later than one hour after the operating period)

ENTSO-E, through dedicated working group, is currently assessing the potential overlapping requirements of publication between the 543/2013 regulation and the balancing network code. Subsequently the Manual of Procedures will be updated to take into account the new items of balancing requested and to enable these new publications.

At the stage, we foresee that LIBRA platform will submit the Marginal prices of each zone to the central Transparency Platform as required by article 17.j of this regulation.

4.3 Questions for Stakeholders

Q 4.1 Do you foresee any potential competitive advantage arising due to the timing and the nature of the information published?

Q 4.2 Do you have any specific comments regarding Chapter 4 content? (Please indicate sub-chapter reference when possible)

5 Governance

5.1 Current governance of TERRE

The TERRE cooperation currently consists of 6 members. All members have signed a Cooperation Agreement (CA) which sets out the legal, technical and financial modalities according to which all the members will cooperate for the implementation phase of the TERRE Project, such phase consisting of the launching of a tendering process and the development of the IT tool necessary to launch the operational phase.

The governance is therefore organized by the agreement and signed by all members.

Currently, each member is accountable for an equal share of costs and has therefore one vote in the Steering Committee, and decision are made by unanimity. This governance process may change in the future, notably in order to comply with the requirements of the GL EB. As a reminder, the guideline establishes a cost-sharing mechanism that is completely different from the one currently used in the TERRE Project (the distribution key of the code does not only rely upon how many costs are incurred by the TSO participating to the platform, but also on the consumption of the Member State). Such changes will be further discussed within the project in the coming months and will be, in compliance with the adopted version of the code, be implemented once the implementation framework of the platform has been approved by the NRAs. Any TSO entering now into the TERRE Project will have the opportunity to witness and/or contribute to the elaboration of such governance framework.

The CA also sets out the conditions under which a new TSO can join the initiative. Such entry can be done under two different status: either as an Observer (which means that such TSO does not have any voting right nor does it pay any share of the costs, except a contribution to the costs related to the administrative part of the project), or as a member, which means a contribution to all the costs as well as the right to vote. Any TSO interested in the project must needs to sign a non-disclosure declaration to obtain further information.

5.2 Governance of the European RR platform (LIBRA)

The future governance framework will be updated based on the GL EB requirements, such as the cost sharing and the decision power principles. These adaptations will be implemented once the TERRE project, developing the LIBRA platform will be approved as the official European platform. These future governance rules will be submitted for validation under the Implementation Framework package, jointly by all the TSOs using RR.

5.3 Questions for Stakeholders

Q 5.1 Do you have any comments regarding Chapter 5 content? (Please indicate sub-chapter reference when possible)

6 Local implementation – Market rules

6.1 REE

- **RR hourly market:** Currently, the RR market is opened sometimes between ID sessions, and the activations can last from 1 hour to several hours. Now, an hourly market with fix GCT will be established (24 RR GCT and each one covering 1 hour)
- **RR energy GCT and submission of bids:** (currently: the RR energy market is open when a high deviation between ID sessions is foreseen. Now, the Spanish system is working for the implementation we will go to an hourly market that is open every hour)
- **Scheduling of BSPs: and Imbalance Adjustment from block to ramp (only applied to RR product):** the shape of the XB shall be as close as possible to the physical delivery in order to avoid increasing the area control error and thus reducing imbalances for BSPs/BRPs. The XB exchange will have a trapezoidal shape with 10 minutes ramps; hence REE is planning to ask the Spanish BSPs to deliver similar balancing profiles (energy imbalance adjustment), taking into account these ramps (Model B). The monitoring would be in energy (through the BRP) and will enable the BSPs to give a smooth energy delivery avoiding unnecessary imbalances and reducing the area control error, especially in the change of the hours. The proposal is to apply this imbalance adjustment method only for the RR product.
- **Other:** Also, other issues are under analysis e.g. removal of floor price for balancing energy according to the GL EB (currently: no negative prices are accepted in balancing markets)

6.2 REN

- **The RR energy GCT and submission of bids**: A 24 RR GCT will need to be implemented for TERRE
- **Distinction between mFRR and RR:** In Portugal there is no distinction between RR and mFRR. One of the fundamental changes will be the clear distinction between these two products.
- **Improvement of the RR prequalification process:** the technical part of the RR prequalification process is foreseen to change in order to take into account the standard RR product requirements
- The IT systems have to be changed in order to accept all the types of offers defined in the TERRE project, and possibly, according to the regulators' decision, to allow negative prices to balancing energy, accordingly to the proposal in chapter 2.3.3

6.3 RTE

Current rules:

The French balancing model largely relies on the empowerment of stakeholders (no restrictions on XB exchanges on the ID markets, financial responsibility) and the markets being given a free rein to operate. As a counterpart, the TSO is continuously informed about the system's status (unit based scheduling starting from DA for power generating units, obligation to offer unused balancing resources for power generating units connected up to the transmission grid, option to formulate balancing bids for demand response facilities and power generating units connected up to the distribution grid outside of all procurement processes), and balancing is performed in a centralised manner in the TSO's exclusive action window.

This model makes it possible to jointly manage balancing and network constraints on the grid: an action taken on the supply-demand balance within the framework of the balancing market is also analysed relative to the impact that it has on the network flows. Thanks to the finely-tuned coordination between balancing and congestion management, the power system is managed in an optimal way.

The TSO proactively balances the power system and uses the "dynamic margin monitoring" security model, guaranteeing that the available margins are monitored within the power system.

Main changes:

RR products: RTE will use standard products for the balancing resources corresponding to the RR characteristics instead of implicit balancing bids with heterogeneous characteristics.

TSO's need: Currently RTE is free to act at any time to balance the power system and submits its balancing need to a national merit order list. With the implementation of the guideline on Electricity Balancing, there will be (i) a net separation between the ID markets and the TSO's balancing activity and (ii) TSO's need will be submitted to the activation optimisation function.

Settlement principles: Currently the settlement of balancing energy bids is based on pay as bid and the TSO-BSP model is used for XB exchanges. With the implementation of the guideline on Electricity Balancing, balancing energy bids from standard products will be settled at marginal price and a TSO-TSO model will be used for XB exchanges.

6.4 Swissgrid

The main changes that Swissgrid is planning to implement in order to be consistent with the RR harmonized market are summarized below:

- **Distinction of mFRR and RR**: Swissgrid is currently using a common merit order list for RR and mFRR. One of the fundamental changes will be the clear distinction

of the two products. Therefore, the imbalances anticipated before the GCT of the LIBRA platform will be covered by RR as long as the results respect the need price, whereas the imbalances anticipated after the CGT of the LIBRA platform will be covered either by mFRR or aFRR.

- **Move from pay-as-bid to pay-as-clear:** the BSPs activated through the current RR market are settled with pay-as-bid. In order to be consistent with the RR harmonized market, Swissgrid is planning to change the BSPs settlement scheme to be based on pay-as-clear.
- **Change of requested balancing profiles from block to ramps:** the shape of the XB exchange shall be as close as possible to the physical delivery in order to avoid increasing the area control error. The XB exchange will have a trapezoidal shape with 10 minutes ramps; hence Swissgrid is planning to ask the Swiss BSPs to deliver similar balancing profiles.
- **Adaptation of the RR prequalification process**: the technical part of the RR prequalification process is foreseen to change in order to take into account the standard RR product requirements. For instance, units with FAT equal to 30 minutes will also be able to participate in the RR harmonized market. It is expected that the BSPs that are currently prequalified for providing RR will not be requested to repeat the prequalification process. The changes are foreseen to be implemented before TERRE goes live.

6.5 TERNA

The main changes that Terna is planning to implement in order to be consistent with the RR harmonized market are summarized below:

- **Distinction of mFRR and RR**: Terna currently makes no distinction between Replacement Reserve and manual FRR (tertiary reserve). We only distinguish between automatically activated products and manually activated products. One of the fundamental changes will be the clear distinction of the two products that will be introduced in the national network code.
- **Move from pay-as-bid to pay-as-clear:** the BSPs activated through the current integrated scheduling process are settled with pay-as-bid. In order to be consistent with the RR harmonized market, Terna is evaluating the possibility to change the BSPs settlement scheme for the common platforms for the exchange of balancing energy to be based on pay-as-clear.

6.6 NGET

The GB balancing philosophy is largely centred on incentivising BSPs to self-balance through the use of imbalance pricing. National Grid remain informed about the overall system's position (through the submission of scheduling data from market participants), and balancing is performed in a centralised manner in the designated system operation time.

It is vital for National Grid to jointly manage balancing and network constraints on the grid in a highly integrated way in order to ensure that system security is maintained and actions are taken in the most efficient way possible

The GB electricity market currently uses a variety of bespoke ancillary services and products in order to balance the system. Notably a great deal of balancing is done through directly activating offers via the Balancing Mechanism. Therefore Replacement Reserves (and the other standard products defined in the European Guidelines) are not easily mapped across to existing GB products. The introduction of the standardised product will be a big change in itself. Submitting needs to a central platform with and implicit scheduled activation will be a significant move away from the current system of directly activating bids from a merit order list as and when needed. It will be important to ensure that the new and existing tools available for energy balancing work alongside each other effectively.

Another key change to facilitate the implementation of TERRE will be the move from pay as Bid settlement with BSPs to Pay as Clear. Once again, it is important to ensure that the two systems of settlement work appropriately alongside each other.

6.7 Questions for Stakeholders

Q 6.1 Do you have any comments regarding Chapter 6 content? (Please indicate sub-chapter reference when possible)

7 Planning

The TERRE project aims to establish the main market functioning of the LIBRA platform by end 2019 as requested by the GL EB 2019).

In parallel to the central platform development and the preparation of the operational framework and RR market, the national preparation will take place simultaneously, to ensure rediness for the exchange with the LIBRA platform, once operational. The national redesign activities are not in scope of this consultation paper. Figure 7-1 visualises the high level TERRE project planning.

7.1 LIBRA implementation planning

In order to assure a smooth implementation of the LIBRA platform, the TERRE project has defined several working packages. The first milestone of the implementation phase will be the RFP launch and the selection of the supplier. Following the selection, drafting of the functional specifications, test cases and the development of the LIBRA platform will take place.

The national implementation will take place in parallel to the LIBRA development. The status of the national implementation progress will be followed closely by the ITWG and the TWG in order to assure a timely readiness of all the systems for the Go-Live.

Additional to the technical design, a specific work package has been assigned to the Legal department in order to prepare the operational governance of the LIBRA platform after the Go-live.

7.2 RR harmonized market implementation planning

The TERRE planning includes the harmonization of the RR market in order to establish a levelled playing field for the market participants. This consultation phase is part of this RR work package.

7.3 Parallel Run phase and BSP involvement

The Parallel run phase is indicated as a separated section because it will encompass the participation of the RR market participants including the national BSPs. This phase is the end to end testing slot which will challenge the readiness of the LIBRA platform, the TSOs and the local BSPs. The communication, exchange of information, fall-back procedures and incidental processes will be verified. In order to conduct the parallel run, the TERRE project will request the involvement of the BSPs to couple to the testing environment, in parallel with the daily processes.

7.4 Questions for Stakeholders

Q 7.1 Do you have any comments regarding Chapter 7 content? (Please indicate sub-chapter reference when possible)

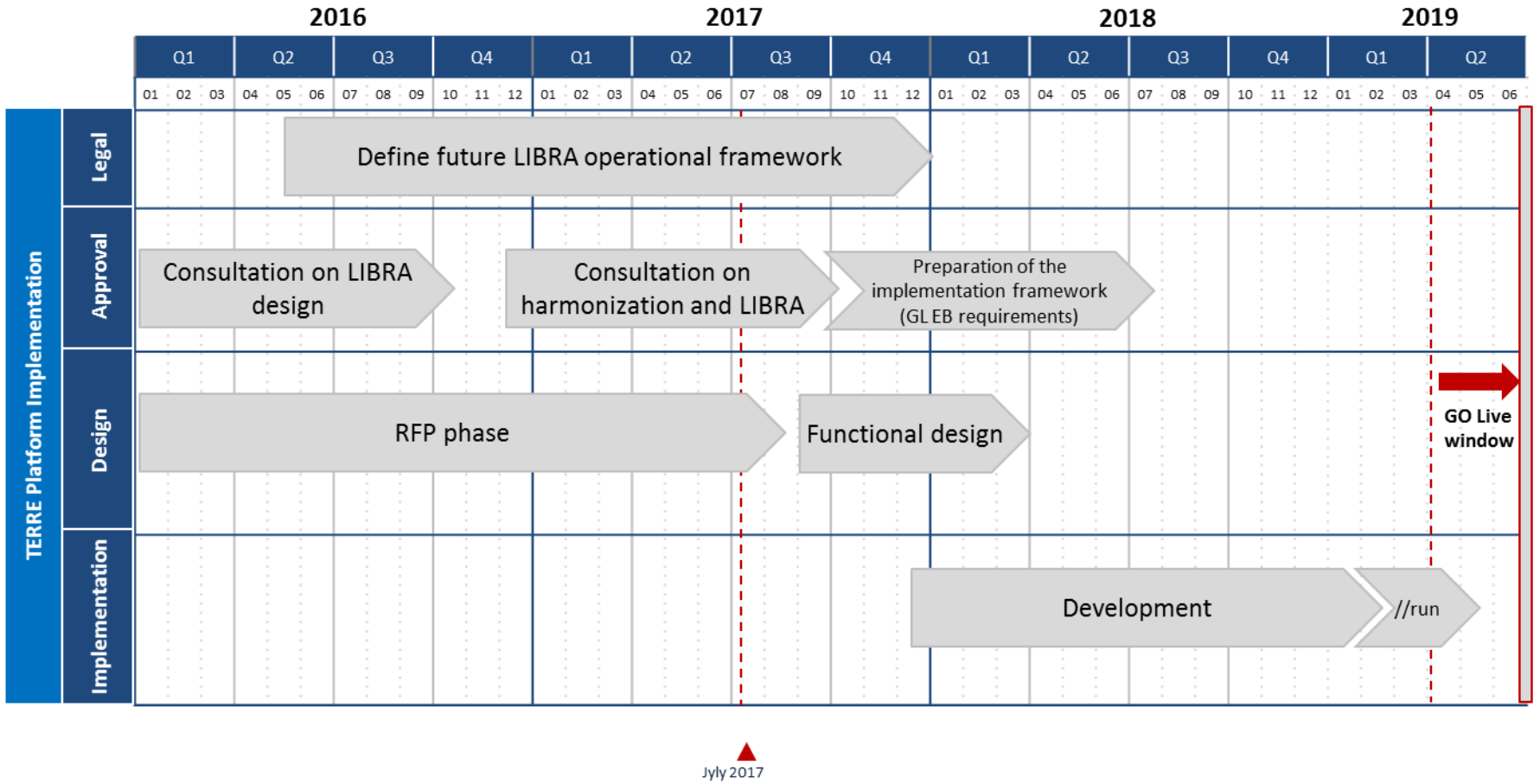

Figure 7-1: TERRE implementation planning

8 Next steps

8.1 Possible evolution

Additional TERRE process: Reduction of Market Time Unit or ID GCT: The evolution of the European electricity market could lead to a reduction of the Market Time Resolution or the ID GCT. If this happened, the project would need to be adapted to new circumstances; for example, possible introduction of additional clearings. This target must comply with the reduction of the XB scheduling steps within TERRE geographical scope as explained in chapters 2.4 and 2.7.2

Additional balancing products and processes: The centralized IT platform will be implemented with enough flexibility to handle different processes and products (e.g. scheduled balancing products, mFRR process…)

8.2 Questions for Stakeholders

Q 8.1 **Do you have comments regarding chapter 8 content? (Please indicate subchapter reference when possible)**

9 Glossary

9.1 Abbreviations

AC	Alternative Current
ACER	Agency for the Cooperation of Energy Regulators
aFRR	automatic Frequency Restoration Reserve
ATC	Available Transmission Capacity
BALIT	Balancing Inter TSO
BMRS	Balancing Mechanism Reporting Service
BSP	Balancing Service Provider
BRP	Balancing Responsible Party
CA	Cooperation Agreement
CDS	Central Dispatch System
CMO	Common Merit Order
CMOL	Common Merit Order List
CZ	Cross-Zonal
DA	Day Ahead
DA MCR	Day Ahead Market Coupling of Regions
DC	Direct Current
DSR	Demand Side Response
EB	Electricity Balancing
ECBC	Electricity Cross Border Committee
ENTSO-E	European Network of Transmission System Operators for Electricity
FAT	Full Activation Time
FRR	Frequency Restoration Reserve
GCT	Gate Closure Time
GL	Guideline
GL EB	Guideline on Electricity Balancing
HVDC	High Voltage Direct Current
ICRP	Interconnector Reference Program
ID	Intra Day
IGCC	International Grid Control Cooperation
IP	Imbalance Price
ISP	Imbalance Settlement Period
ITWG	IT Working Group
LF	Loss Factor
mFRR	manual Frequency Restoration Reserve
MOL	Merit Order List
MoU	Memorandum of Understanding
MRC	Market Coupling of Region

NA	Not applicable
NC LFC&R	Network Code Load Frequency & Reserves
NRA	National Regulatory Authority
REMIT	wholesale energy market integrity and transparency
RFI	Request for Information
RFP	Request for Proposal
RR	Replacement Reserve
SO	System Operator
TERRE	Trans European Replacement Reserve Exchange
TWG	TERRE Working Group
TSO	Transmission System Operator
UAB	Unforeseeably Accepted Bid
UO	Upper Offer
URB	Unforeseeably Rejected Bid
XB	Cross Border
XBID	Cross Border Intraday
XBMP	Cross Border Marginal Price

9.2 Definitions

Delivery Period: a time period of delivery during which the Balancing Service Provider delivers the full requested change of power in-feed or withdrawals to the system.

Divisibility: the possibility for the TSO to use only part of the balancing energy bids or Balancing Capacity bids offered by the Balancing Service Provider, either in terms of power activation or time duration. As requested by the Guideline on Electricity Balancing this parameter will be under the responsibility of BSPs. This feature is strictly related with the Maximum Bid Size.

Full Activation Time (FAT): the time period between the activation request by TSO and the corresponding full activation of the concerned product. The FAT is the sum of the Preparation Period and the Ramping Period. The FAT is set between 0 to 30 min. Lower values can cause conflict with mFRR process.

The TERRE Project defined only the FAT in order to give the maximum level of flexibility to the market.

For example you can have two different production units:

- Unit A: Preparation Period = 5 minutes, Ramping Period = 25 minutes;
- Unit B: Preparation Period = 25 minutes, Ramping Period = 5 minutes.

Both the production units are able to join the mechanism.

Location: The level of detail of this parameter is the Bidding Zone.

Imbalance volume definition: The general principle on how the imbalance volume is calculated (Art 54 of the GL EB) for which the imbalance price will be applied

Maximum Bid Size: the maximum amount of MW a BSP can aggregate in a single offer. This parameter is related to the divisibility of the offers:

- in the case of a divisible offer, no maximum bid size will be applied;
- in the case of an indivisible offer, in order to avoid market arbitrage, the application of a cap is needed. Considering the differences between the regulations of the Countries involved, the TERRE Working Group decided, at least in a first stage, that local rules will be implemented.

The **Maximum delivery period** represents the maximum time during which the BSP can deliver the full requested power. It is set to 60 minutes. This value was introduced in order to avoid any interference with the cross-border intra-day markets.

The combination of a Minimum delivery Period of 15 minutes and a Maximum delivery Period of 60 minutes means that a BSP will be able to offer a product with a duration of 15, 30, 45 or 60 minutes.

The **Minimum delivery period** represents the minimum resolution time of each offer. It is set to 15 minutes. This value was introduced in order to give higher flexibility to the market.

Minimum Quantity: the minimum value that a BSP can offer. Small values lead to higher flexibility for BSP. The minimum value is set to 1 MW.

Preparation Period: means the time duration between the request by the TSO and start of the energy delivery. The Preparation Period can be from 0 to 30 minutes.

Price: the definition of the price of the bids will be under the responsibility of the BSPs (respecting local rules). Actually negative prices cannot be accepted by several TSOs. This issue will be submitted to the NRAs.

Ramping Period: a period of time defined by a fixed starting point and a length of time during which the input and/or output of Active Power will be increased or decreased. The Ramping Period can be from 0 to 30 minutes.

Recovery Period: the minimum time between the delivery period and the following activation of an offer presented by a BSP. It will be defined by the BSP.

Resolution: Having a resolution of 0.1 MW means that, in case an offer is partially accepted (e.g. pro rata), the value will be rounded at the value with one decimal number.

Social Welfare: Area between the buying (positive imbalance needs/downward offers) and the selling (negative imbalance needs/upward offers) curve.

Validity Period: the time period when the balancing energy bid offered by the Balancing Service Provider can be activated, whereas all the characteristics of the product are

respected. The Validity Period is defined by a beginning time and an ending time. It will be defined by the BSP but cannot exceed the Maximum delivery period (60 minutes)

10 Summary of questions for Stakeholders

Stakeholders are invited to answer the following questions, directly linked to the chapters of this document.

A dedicated tool is available on ENTSO-E website at the address communicated in the launch letter of this consultation. Please be aware that only comments made using this channel will be taken into account.

Preliminary remarks:

- Questions marked by (*) are open questions on the specific section.
- Question marked by (**) is an introduction question where stakeholders can freely comment on the whole content of the chapter and share opinion on TERRE project in general.

Chapter	Question ID	Questions
1: Introduc-tion	Q 1.1**	Do you have specific comments regarding Chapter 1 content? (Please indicate sub-chapter reference when possible)
2: TERRE TSO-TSO Model	Q 2.1*	Do you have specific comments on the LIBRA platform description?
	Q 2.2*	Do you agree with the allowance of counter-activations in TERRE and it impact on the marginal price and the ID market?
	Q 2.3*	Which approach would you prefer to follow regarding unforeseeably rejected bids?
	Q 2.4*	Do you agree with the way energy losses are treated in TERRE?
	Q 2.5*	Do you agree with the physical feasibility description and its calculation?
	Q 2.6*	Do you agree with the proposed interconnection control-lability through TERRE?
	Q 2.7*	Do you agree with the introduction of unavailable bids feature in the TERRE TSO-TSO process?
	Q 2.8*	What is your view on the proposed method for TSO-TSO settlement (pay-as-cleared and block energy settlement between the TSOs)?
	Q 2.9*	What are your views on the proposed solution for price indeterminacies?
	Q2.10*	Do you agree with the definition of congestion rents?
	Q2.11*	Do you agree with the proposal for caps/floor prices harmonization?
	Q2.12*	What is your point of view on the TSO-TSO XB commer-cial scheduling step?
	Q2.13*	Do you agree with the proposed definition of imbalance needs and their flexibility and elasticity?
	Q 2.14*	What are your views on the proposed solution for the TSO-TSO process?

	Q 2.15**	Do you have any comments on the information given in this section? (Please indicate sub-chapter reference when possible)
3. TERRE TOS-BSP and TSO-BRP harmonised rules	Q 3.1*	Do you have any specific comments regarding the criteria used to characterize the current local RR balancing product profiles and formats allowed by the LIBRA platform?
	Q 3.2*	Do you have any specific comments regarding the criteria used to characterize the current local BSP-TSO and BRP-TSO settlement procedures?
	Q 3.3*	Do you see a possible competitive advantage arising from delivering either the trapeze or block offer?
	Q 3.4*	Do you agree with the description provided to describe the current local GCT situation for RR?
	Q 3.5*	Do you have any specific comments regarding the definition of the BEGCT and the proposed timings, namely the proposal of the BEGCT to be H-60min?
	Q 3.6**	Apart from the elements given in Chapter 3, do you think other TSO-BSP and TSO-BRP elements should be harmonized? If yes which ones?
	Q 3.7**	Following the information provided in Chapter 3, could you indicate, what are your three harmonization priorities?
	Q 3.8**	Do you have any additional comments regarding Chapter 3 content? (Please indicate sub-chapter reference when possible)
4. Transparency	Q 4.1*	Do you foresee any potential competitive advantage arising due to the timing and the nature of the information published?
	Q 4.2**	Do you have any specific comments regarding Chapter 4 content? (Please indicate sub-chapter reference when possible)
5. Governance	Q 5.1**	Do you have any specific comments regarding Chapter 5 content? (Please indicate sub-chapter reference when possible)
6. Local implementation - Market rules	Q 6.1**	Do you have any specific comments regarding Chapter 6 content? (Please indicate sub-chapter reference when possible)
7. Planning	Q 7.1**	Do you have any specific comments regarding Chapter 7 content? (Please indicate sub-chapter reference when possible)
8. Next steps	Q 8.1**	Do you have specific comments regarding chapter 8 content? (Please indicate sub-chapter reference when possible)

11 Annex

11.1 Definition of marginal price (pay-as-cleared):

The Marginal Price shall be based on the prices of the activated balancing offers from BSPs and, if relevant, on the prices of the satisfied TSO imbalance need (in case of elastic needs). Graphically, this Marginal Price will be given by the intersection between the selling and buying curve in the TERRE CMO, being:

- Selling curve: Upwards offers and downward imbalance needs
- Buying Curve: Downwards offers and upward imbalance needs

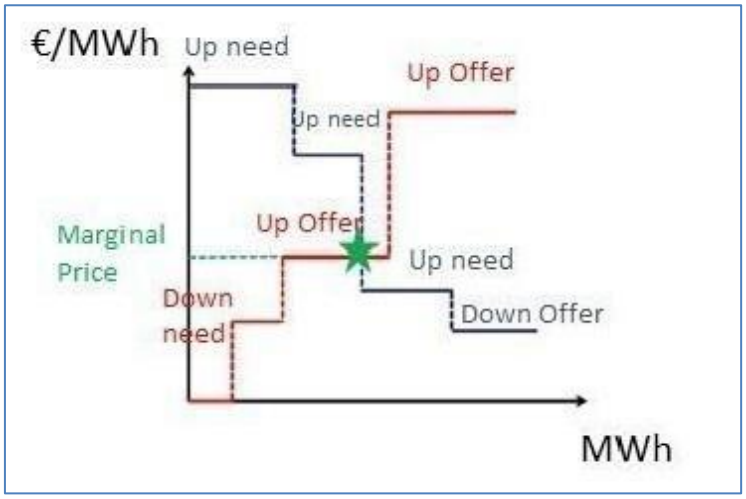

Figure 11-1 Definition of Marginal Price

The following considerations will be taken into account for the TSO-TSO settlement:

- There is a single price for each bidding zone (even if 2 bidding zones correspond to the same TSO), as downward and upward offers as well as Imbalance Needs are treated in the same optimization problem; hence, there is no separate price for downward and upward activations.
- A set of non-congested bidding zones, have the same marginal price.
- In case of congestion on one border, there could be different prices at both sides of the interconnector (different "TERRE Bidding Zones").
- As the basis for the TERRE product is 15 min (minimum duration = 15 min), there will be a Marginal Price every 15 min (or more Marginal Prices, in case there is congestion)

11.2 TSO-BRP settlement

As a project with the aim of becoming a European platform, the implementation of TERRE will be in line with the provisions of the GL EB. So, the TSOs of TERRE will work together with ENTSO-E as well as with Stakeholders, ACER, the NRAs and the EC in order to design and apply the correct provisions related to TSO-BRP settlement.

11.2.1 Imbalance Settlement Period

In relation to the Imbalance Settlement Period:

- The GL EB says establishes that, 3 years after the entry into force of the GL EB, the ISP should be established in 15 min in all control areas. Nevertheless, it considers exemptions at a Synchronous Zone level (subject to common proposal of all TSOs of the SA) and considers a possible derogation until 1st January 2025 in each system
- The Clean energy Package proposal says that, on 1st January 2025, the ISP shall be set to 15 min in all Europe.

Currently, the systems that use RR have different ISPs (see table of ISP in Europe):

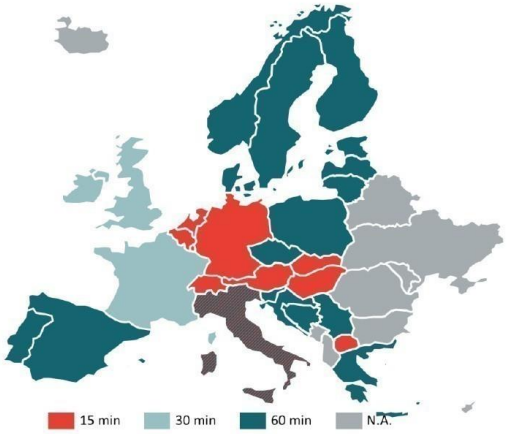

Figure 11-2: Imbalance Settlement Periods in Europe (Source: ENTSO-E)

As the imbalance settlement period exceeds the competences of the TERRE project, this issue will not be analysed under this consultation. The TSOs will work together with ENTSO-E as well as with Stakeholders, ACER, the NRAs and the EC in order to follow the provisions of the GL EB and the future Clean Energy Package.

11.2.2 Imbalance settlement price

The GL EB says that, among others, the imbalance settlement principles shall:

- establish adequate economic signals to reflect the **imbalance situation**;
- ensure that imbalances are settled at a **price that reflects the real time value of energy**;
- provide **incentives to balance responsible parties** to be in balance or help the system to restore its balance;
- facilitate harmonisation of imbalance settlement mechanisms;

Then, the GL EB establishes maximum /minimum limits for the definition of imbalances aggravating the system imbalance, thus allowing for both schemes (single pricing/dual pricing).

As the imbalance settlement price exceeds the competences of the TERRE project, this issue will not be analysed under this consultation. The TSOs will work together with ENTSO-E as well as with Stakeholders, ACER, the NRAs and the EC in order to follow the provisions of the GL EB and the future Clean Energy Package.

11.3 TERRE product precision

One of the questions raised by the stakeholders in the previous Consultation Paper was related to the definition of the maximum duration of the offer: stakeholders requested if the maximum duration of the offer could exceed one hour. The answer was that the maximum duration of the offer cannot exceed one hour. An offer with a maximum duration of the offers that is more than one hour will interfere with the results of the ID Market (XBID market) of the following hour and couldn't be activated by any TSO.

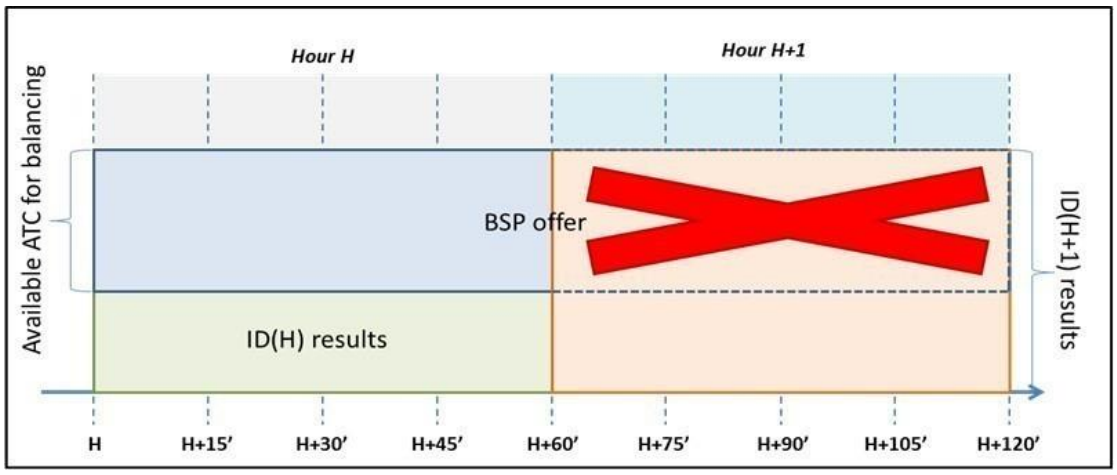

Figure 11-3: Explanation exceeding of Maximum Duration of the offer

The same will apply if the Market time Unit of the XBID will be reduced. There is also a strict relation between the XB scheduling step, the number of clearings of the XBID and the maximum duration of the offers of the TERRE product.
We could have three different situations: XB scheduling step equal to 60min, 30min and 15min.

XB Scheduling Step = 60 Min

In case there is a need (or an obligation) from some TSOs, it will be allowed for the connected BSPs to submit 60min offers with the different Bid formats.

XB Scheduling Step = 15 min

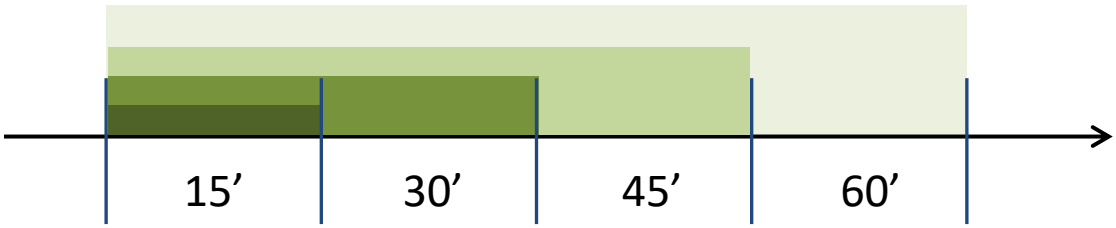

Figure 11-4: XB scheduling step = 15 min

In this case every offer (divisible, block, multi-part) could be allowed (15, 30, 45 and 60 min) if there is only one clearing for the XBID.

Note that in all cases if there is more than one GCT time per hour in XBID, then the current process has to be adapted, i.e., more than one clearings per hour for TERRE would also be necessary. This can obviously be possible only for XB scheduling step of 30 or 15 minutes.